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Abstract: The effect of this research will help marketers of shoes giant of Bangladesh such as BATA, APEX, BAY FOOTWEAR and LEATHEREX FOOTWEAR to identify varieties useful promotional tools that will greatly influence the purchasing behavior of customers and also demonstrate how marketing solutions are being performed by shoe giants like Adidas and Nike. This fact-finding paper will demonstrate correlation between promotional strategy and purchasing behavior of consumers which will help the companies to create vital business plan and value their advertisement to increase productivity and strengthen their operational platform to create competitive advantage in the market and eventually acquire more percentage in profits through maximization of sales. Subsequent information regarding the study has been accumulated from various shoe stores in Dhaka. The research pragmatism will also identify different problems with the marketing, manufacturing and retailing strategy of the shoe companies and show evidence of what their competitors are executing better than them in the market for the benefits of these probed companies so that they become more organized and come closer to their potential customers by understanding their attitudes towards buying a product.

Index Terms: Promotional Tools, Customer Attitudes, Marketing Strategy, Footwear Industry of Bangladesh.

1. Introduction: In this modern era where businesses are going global promotional strategy concept have become a significant part of an organization’s layout which helps them to spread the word and become more perceivable about themselves among the customers [26]. Promotional strategy aids a company to pull customers into buying their product and also rationalize the customers that their product can give higher values compared to their rivals. Through use of Promotional Strategies a company gives different sales offers to stimulate the customers of buying a product hence boosting sales and become more lucrative. Promotional of a product is made through Buy 1 Get 1 Free Offer, Coupons/Discounts and Price Reduction is also considered to be one of the key drivers for the success of a business as it creates a strong image among the customers and selling the product in cheaper price increases sales and returning of the customers to buy more [3]. It is also important to understand the purchasing behavior of customers because modern sophisticated customers are becoming selective about shopping, the product-life cycle of a particular product is becoming shorter and the rate of success of launching new products is decreasing, meanwhile factors such as social, cultural and ethical values also pressurize the purchasing behavior of these customers [31]. Business research works as a guideline which provides information to make managerial decisions more distinctively as it is a process of planning, achieving, resolving and determining the actions that a company can implement to maximize their earnings [12]. There has been significant change in the casual footwear industry in recent years as shoes are no more just for the rich people, it has become choice for people of all income class. According to Leather Goods and Footwear Manufacturers and Exporters Association of Bangladesh (LGMEAB) the annual growth rate of footwear industry is 21 percent and it is estimated that the export of footwear has increased to $300 million in 2011 [7]. Shoe industries in Bangladesh is changing so significantly that most of the Bengali people can afford to buy shoes of their choices and it has only became possible because of intense competition, growth of economy and easy accumulation of resources. Companies like BATA, APEX, BAY FOOTWEAR and LEATHEREX FOOTWEAR has been operating in Bangladesh for many years but with the growing competition among themselves and others has made it problematic to attract clienteles therefore this research work will focus on factors which will help these companies to grow and specifically provide promotional strategies and tools that will help the managers of these shoe companies to increase performance and revenue [4]. This research work will not only help managers and marketing officers of the shoe companies to implement new promotional strategies but also give new insights into demographics and also identify which particular set of customers are there actual buyers. Understanding Patrons Purchasing Behavior is a crucial factor as it varies from age to age, gender to gender therefore throughout the research work there will be use of different primary data selections and appropriate sampling techniques to help these companies earn more profitability, expand their operational channels and also create unique products for new generations of consumers [8]. Contemporary market problem suggest that footwear companies in Bangladesh lacks in giving different promotional offers both in on-season and off-season, they are also lacking in understanding different demographics...
and customer purchasing behavior as they do not follow proper marketing strategy. These companies are also inadequate in terms of creating new innovative products or implement critical strategies for modification of advertising [10]. To classify the use of Promotional Strategies to realize the purchasing behavior the author urges the following questions: (1) How to understand customer purchasing behavior in the growing economy of Bangladesh? (2) What are the different strategies of promotion and how to implement it which will assist companies to increase sales volume and profitability? To answer the research questions the study will be guided by the following objectives: (1) to identify different demographics, their purchasing behavior, and their product of choice and particular sets of sales offer which attracts patrons the most. (2) To produce relevant recommendation for the industry to achieve prosperity in the future. This particular investigation will prove to be beneficial for marketing officers and managers of footwear companies in Bangladesh. University Students, Scholars, Academic Professionals can also find the work favorable for studying purposes related to Marketing. If supervised adequately, this particular research work can help nourish the prospering footwear industry of Bangladesh [13].

2. Literature Review: Making businesses thriving is always challenging for the Owners and Marketing officers are always pressurized to identify new scopes to advertise and develop sales, due to rigorous competition and vast brands to choose from Customers are also becoming more prices conscious and looking-out to the best deals a Company has to offer [24]. Therefore shoe companies usually has to rely on complex and alluring Promotional Offers to ensure the patrons are keep coming towards them instead of their opponents in the market [26]. It is estimated that expenditure on sales promotion have increased by 600% as shoe companies are investing more money on promotions compared to advertising as this strategy is concerned to be more effective by top level management [6]. BATA and APEX being some of the biggest footwear companies of Bangladesh is losing its market shares to the rivals both in local and international market. Bangladesh is a country of emerging economy with various cultural influences, Income level of people are increasing and Bengali people are fond of buying new shoes on occasions such as POHELA BOISHAK, EID-UL-AZHA, EID-UL-FITR, Christmas etc. [22]. For example- During EID-UL-FITR, 2015 Apex gave 50% off in all their products, in a result the company was able to clear most of their stock, earn profitability and got the opportunity to store new products for the next season, Hence it is important to handle Promotional Strategies in a tactical approach rather than perspective [34] [2].

Internal Factors:

**Buy 1 Get 1 Free Offer:** For decades companies tried to identify new innovative ways of improve the sales of their low-demand products and one of the most prominent promotional strategy they used is Buy 1 Get 1 Free Offer. This strategy is undoubtedly most seen in the footwear sector as shoe companies use this particular strategy to clear out their old stocks with minimal profit and bring new inventory for the customers [5]. Being a progressing country this strategy proven to be very successful among Bengali society especially mid and lower class people. For example: Shoe companies and different high ends restaurants uses this strategy whether to clear the old stocks, investigate customer feedback or just to construct a good brand actualization among the purchasers [27].

**Coupons and Discounts:** Nowadays customers are moving away from promotions through coupons which gives them discounts on a specific set of merchandise because of obvious reasons such as customers tend to lose the coupon receipts and as these sort of coupons perish after a limited period of time it result in shopper not being able to use those effectively [1]. For example: In 2008, Pizza giant Dominos in Bangladesh used this strategy to induce more customers but was unsuccessful as the customers who bought the voucher faced problems regarding the time limitations in coupons and the company providing bad quality Pizza to the customers who presented them the coupons [3].

**Price Reduction:** Another famous promotional strategy that competitive company’s uses to both endorse and increment the sales of their products is price reduction strategy. This strategy helps customers who are suffering from financial crisis the advantage of testing the product in the market and also assist organizations to increase their sales and clear off debts efficiently [11]. For example: In US during the Christmas season electronic companies offer reduced price on their products which is also known as Black Friday so that they can get rid of the unsold products and bring new ones to keep themselves competitive in the market. This strategy is also relevant for consumer goods as most of the products in this category has an expired dates therefore firms such as Wal-Mart, TESCO, Amazon, E-bay etc. promotes the products through price reduction strategy so that the commodities are sold before it lapses [14].

External Factors:

**Physical Surroundings:** It is an external factor that puts an impact on the sales of the products and also creates a platform to reach more customers. A company with more outlets means it is able to reach more potential customers and sell more of their products [17]. For example: Multinational companies such as Zara, Gucci, Japan Tobacco, Apple are opening new offices or sales outlets on
different countries through Franchising or licensing to reach more prospective consumers and earn more profitability through the process and local companies like BATA is also expanding by opening new sales outlets on different districts of Bangladesh and it currently has around 302 outlets around the country to become more close to potential customers and increase both their revenue and income [21] [18].

**Speculation and Investments in Corporate Social Responsibilities of Bangladesh:** For Years researcher have argued that organizations must donate a decent amount of their earnings to the society and take care of the environment where they operate as effective CSR creates a positive impression towards the customers [33]. Footwear companies of Bangladesh must become more socially responsible such as donate money for education of poor children and plant trees to keep the environment clean because this particular industry produces huge amount of waste materials to devise their products therefore they must initiate different programs to ensure their customers that the companies are actually implementing something good for the country [29].

**Lawful Proceedings:** Adequate legal practices among firms is an important antecedent in order for businesses to increase persistent and also to spawn a positive characterization among the customers. Countries like Denmark, New Zealand and Sweden are known to be the best in terms of conducting businesses due to their least corrupt Government whereas Bangladesh has highly corrupted Government therefore it becomes hard to conduct or maintain a good business without dispensing bribes [23]. Moreover footwear companies in Bangladesh must also be aware that facing legal actions for creating environmental hazards by disposing waste materials of shoes directly in the river or street can actually jeopardize their brand image among the customers and result disturbance in sales [19].

3. Research Model and Hypothesis:

![Figure 1: Theoretical Model.](image-url)
H1: Predicts that Buy 1 Get 1 Free offer has Positive Impact on Consumer Behavior.

H2: Predicts that Coupons and Discounts have Positive Impact on Consumer Behavior.

H3: Predicts that Price Reduction in Product has Positive Impact on Consumer Behavior.

H4: Predicts that Physical Evidence or Sales Outlets have Positive Impact on Consumer Behavior.

H5: Predicts that Investments in Corporate Social Responsibility puts a Positive Impact on Consumer Behavior.

H6: Predicts that proper legal practices sets a Concrete Impingement on Consumer Behavior.

4. Research Methodology: This research paper comprises the analysis of the interconnection between promotional strategies of shoe companies in the Footwear Industry of Bangladesh with correlation to its impact on consumer behavior. A survey method was implemented to allocate relevant information required for successful scrutiny of the study. A number of 150 customers of numerous preeminent stores such as Bata, Apex and Bay Footwear were randomly selected and requested to be a participant in the research and the objective of the study was also disclosed to them. The participants were distributed a total of 150 questionnaires illustrating 8 questions regarding the investigation and 120 valid and useful questionnaires were delivered back to the author which gave a response rate of approximately 70% (Percent). The participants consisted of individuals from different level of incomes and various educational backgrounds. The questions represented in the survey focused on understanding the influences of specified Internal and External Promotional factors on the Positive Consumer Behavior. The questions regarding the subject was designed using Likert scale (1= Strongly Agree, 2= Agree, 3= Neutral, 4= Disagree and 5= Strongly Disagree), through which, the respondents were requested to share a perceptible depth of their judgment on the predominant link between the components. Correlation and Regression analysis along with ANOVA Factor Analysis was used to measure the variables for each criterion.

5. Hypothesis Testing and Analysis:

H1: Buy 1 Get 1 Free Offer

Table 1: Predictors (Constant), Buy 1 Get 1 Free Offer.

<table>
<thead>
<tr>
<th>Regression Statistics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
<td>0.814004085</td>
</tr>
<tr>
<td>R Square</td>
<td>0.66260265</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td>0.550136867</td>
</tr>
<tr>
<td>Standard Error</td>
<td>4.474249592</td>
</tr>
<tr>
<td>Observations</td>
<td>5</td>
</tr>
</tbody>
</table>

Through the analysis the author identified that the regression or R= 0.66 or 66% whereas adjusted R square = 0.55 or 55% which eventually states a positive variation among the variables.

Table 2: ANOVA Single Factor Analysis.

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>DF</th>
<th>SS</th>
<th>Mean Square</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>117.9432718</td>
<td>117.9432718</td>
<td>5.891593</td>
<td>0.093558936</td>
</tr>
<tr>
<td>Residual</td>
<td>3</td>
<td>60.05672823</td>
<td>20.01890941</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>178</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
With regard to the ANOVA table, the p-value of Sig-0.155 affirms the legitimacy of the regression model and proclaims it as highly significant at 1% level of confidence. Furthermore, the F-test is disregarded considering the assumption that the test represents the acceptance of the null hypothesis.

**Table 3: Coefficients and P-Value Analysis.**

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>5.266490765</td>
<td>2.794073454</td>
<td>1.884879139</td>
</tr>
<tr>
<td>No. of Customers</td>
<td>0.197229551</td>
<td>0.081256032</td>
<td>2.427260443</td>
</tr>
</tbody>
</table>

*Hereafter, the null hypothesis (H0) is discarded and the alternative hypothesis (H1) is accepted.*

Moreover, the p-values observed above (Sig = 0.15 and 0.09) certify the degree of acceptance between the tested variables at a deserving 1% level, which is also disclosed by the t-stat (Buy 1 Get 1 Free Offer = 5.891) satisfying $t > (\pm) 2$. On a parallel note, the coefficient 5.266 suggests that there is a strong positive correlation between Buy 1 Get 1 Free Offer and Behavior of Consumers. For years, shoe companies are clearing out their stocks of old products by giving away Buy 1 Get 1 Free Offer which resulted to be very relevant for the ongoing demand of getting something free for a particular purchase. It not only helps a company to boost their sales but also create a group of loyal customers who are eager to buy more from these companies [16]. Nonetheless, experimental evidence support the understanding that an enlarging number of consumers tend to buy products from companies that increases their Buy1 Get 1 Free Offer and takes a significant role in promoting of the products for the shoe companies [9].

**H2: Coupons and Discounts**

**Table 4: Predictors (Constant), Coupons and Discounts.**

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
</tr>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

Through the analysis the author justify that the regression or $R = 0.91$ or 91% whereas adjusted R square = 0.89 or 89% which eventually states a positive variation among the variables.

**Table 5: ANOVA Single Factor Analysis.**

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>DF</th>
<th>SS</th>
<th>Mean Square</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>1996.883117</td>
<td>1996.883</td>
<td>33.82314</td>
<td>0.010121709</td>
</tr>
<tr>
<td>Residual</td>
<td>3</td>
<td>177.1168831</td>
<td>59.03896</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>2174</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With regard to the ANOVA table, the p-value of Sig-0.08 affirms the authority of the regression model and proclaims it as highly significant at 1% level of confidence. Furthermore, the F-test is disregarded considering the assumption that the test represents the acceptance of the null hypothesis. However the t stat and intercept shows negative results.

**Table 6: Coefficients and P-Value Analysis.**

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-22.7012987</td>
<td>8.734449353</td>
<td>-2.59905</td>
</tr>
<tr>
<td>Coupons and Discounts</td>
<td>8.051948052</td>
<td>1.384503299</td>
<td>5.815767</td>
</tr>
</tbody>
</table>

*Hereafter, the null hypothesis (H0) is kept as the analysis shows negative results.*
Moreover, the p-values observed above (Sig = 0.08 and 0.01) certify the degree of acceptation between the tested variables at a
deserving 1% level, which is also disclosed by the t-stat (Coupons and Discounts= -22.7) dissatisfying t > (-/+ 2. On a alongside note,
the negative coefficient suggests that there is a strong negative correlation between Coupons/Discounts and Behavior of Consumers. Nowadays, Customers are moving away from Coupons/Discounts and more into other promotional offers such as Get 1 Free or Price Reduction offers as they find it irrelevant and old fashioned to use coupons to get some discounts and sometimes they also loses the
coupon receipt. Therefore broad amount of discount on a particular product via coupon is required to keep the customers coming back
to the stores [4].

H3: Price Reduction

<table>
<thead>
<tr>
<th>Table 7: Predictors (Constant), Price Reduction.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regression Statistics</strong></td>
</tr>
<tr>
<td>Multiple R</td>
</tr>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

Through the analysis the author justify that the regression or R= 0.76 or 76% whereas adjusted R square = 0.68 or 68% which
eventually states a positive variation among the variables.

<table>
<thead>
<tr>
<th>Table 8: ANOVA Single Factor Analysis.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANOVA</strong></td>
</tr>
<tr>
<td>DF</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

With regard to the ANOVA table, the p-value of Sig-0.05 affirms the authority of the regression model and proclaims it as highly
significant at 1% level of confidence. Furthermore, the F-test is disregarded considering the assumption that the test represents the
acceptance of the null hypothesis.

<table>
<thead>
<tr>
<th>Table 9: Coefficient and P-Value Analysis.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coefficients</strong></td>
</tr>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>No. of Customers</td>
</tr>
</tbody>
</table>

Moreover, the p-values observed above (Sig = 0.05 and 0.051) certify the degree of acceptation between the tested variables at a
deserving 1% level, which is also disclosed by the t-stat (Price Reduction= 4.60) satisfying t > (-/+ 2. In terms of shoe companies in
Bangladesh the customers are more into cheap but long lasting products compared to expensive products. Alongside positive
correlation between the two variables suggest there is a strong relation between them as when the companies reduce the price of their
products accordingly the number of customers gradually increases. Therefore reducing the price of the products especially in on-
season or festivals companies can boost their sales and achieve competitive advantage in the shoe market of Bangladesh [28].
H4: Physical Surroundings/ Sales Outlets

Table 10: Predictors (Constant), Physical Surroundings.

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
</tr>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

Through the analysis the author justify that the regression or R= 1 or 1% whereas adjusted R square = 1 or 1% which eventually states a neutral variation among the variables.

Table 11: ANOVA Single Factor Analysis.

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>DF</th>
<th>SS</th>
<th>Mean Square</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>3.461E+32</td>
<td>2.88893E-33</td>
</tr>
<tr>
<td>Residual</td>
<td>2</td>
<td>2.88893E-32</td>
<td>1.44447E-32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With regard to the ANOVA table, the p-value of Sig=1.34 affirms the authority of the regression model and proclaims it as highly significant at 1% level of confidence. Furthermore, the F-test is disregarded considering the assumption that the test represents the acceptance of the null hypothesis.

Table 12: Coefficient and P-Value Analysis.

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1997.9</td>
<td>7.3345E-16</td>
<td>2.72398E+18</td>
</tr>
<tr>
<td>No. of Outlets</td>
<td>0.05</td>
<td>2.68744E-18</td>
<td>1.86051E+16</td>
</tr>
</tbody>
</table>

Hereafter, the null hypothesis (H0) is discarded and the alternative hypothesis (H4) is accepted.

Moreover, the p-values observed above (Sig = 1.34 and 2.88) certify the degree of acceptance between the tested variables at a deserving 1% level, which is also disclosed by the t-stat (Physical Surroundings=1997.9) satisfying t> (-/+). 2. Alongside, the two variables shows very strong correlation with each other states that number of customers eventually increases with number of outlets of a company. Having more stores means the company is expanding into different areas, reaching more customers and capturing more sales for the company. Therefore the author completely agrees with the hypothesis of physical surrounding/outlets [10].

H5: Investments in CSR

Table 13: Predictors (Constant), Investments in CSR.

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
</tr>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

Through the analysis the author identified that the regression or R= 0.97 or 97% whereas adjusted R square = 0.96 or 96% which eventually states a positive variation among the variables.
Table 14: ANOVA Single Factor Analysis.

<table>
<thead>
<tr>
<th></th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>9.72972973</td>
<td>9.72973</td>
<td>108</td>
<td>0.001901275</td>
</tr>
<tr>
<td>Residual</td>
<td>3</td>
<td>0.27027027</td>
<td>0.09009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>10.009614397</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With regard to the ANOVA table, the p-value of Sig-1.21 affirms the legitimacy of the regression model and proclaims it as highly significant at 1% level of confidence. Furthermore, the F-test is disregarded considering the assumption that the test represents the acceptance of the null hypothesis.

Table 15: Coefficients and P-Value Analysis.

<table>
<thead>
<tr>
<th></th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>2005.594595</td>
<td>0.354112505</td>
<td>5663.721</td>
<td>1.21E-11</td>
</tr>
<tr>
<td>Investments in CSR</td>
<td>1.62162E-05</td>
<td>1.56041E-06</td>
<td>10.3923</td>
<td>0.001901</td>
</tr>
</tbody>
</table>

Hereafter, the null hypothesis (H0) is discarded and the alternative hypothesis (H1) is accepted.

Moreover, the p-values observed above (Sig = 1.21 and 0.001) certify the degree of acceptance between the tested variables at a deserving 1% level, which is also disclosed by the t-stat (Investments in CSR = 1.621) satisfying t> (-/+ ) 2. On a lateral note, the coefficient 2005.5 theorize that there is a strong positive correlation between Investments in CSR and Behavior of Consumers. Experimentation testimonial reinforce that Companies who invest more in social responsibilities has higher probability of soliciting more customers to buy their products [33].

H6: Lawful Proceedings

Table 16: Predictors (Constant), Lawful Proceedings.

<table>
<thead>
<tr>
<th></th>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
<td>0.996605645</td>
</tr>
<tr>
<td>R Square</td>
<td>0.993222811</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td>0.990963748</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.004676294</td>
</tr>
<tr>
<td>Observations</td>
<td>5</td>
</tr>
</tbody>
</table>

Through the analysis the author identified that the regression or R= 0.99 or 99% also adjusted R square = 0.99 or 99% which eventually states a positive variation or coequal among the variables.

Table 17: ANOVA Single Factor Analysis.

<table>
<thead>
<tr>
<th></th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>0.009614397</td>
<td>0.009614397</td>
<td>439.6614</td>
<td>0.000237273</td>
</tr>
<tr>
<td>Residual</td>
<td>3</td>
<td>6.56032E-05</td>
<td>2.18677E-05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>6.56032E-05</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With regard to the ANOVA table, the p-value of Sig-0.0049 affirms the legitimacy of the regression model and proclaims it as highly significant at 1% level of confidence. Furthermore, the F-test is disregarded considering the assumption that the test represents the acceptance of the null hypothesis.
Table 18: Coefficients and P-Value Analysis.

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.11892323</td>
<td>-7.469969528</td>
<td>0.004968</td>
</tr>
<tr>
<td>Lawful Proceedings</td>
<td>0.002447657</td>
<td>20.96810431</td>
<td>0.000237</td>
</tr>
</tbody>
</table>

Hereafter, the null hypothesis (H0) is discarded and the alternative hypothesis (H1) is accepted.

Moreover, the p-values observed above (Sig = 0.0049 and 0.0023) certify the degree of acceptance between the tested variables at a deserving 1% level, which is also disclosed by the t-stat (Lawful Proceedings = 0.0024) satisfying \( t > (+/-)2 \). On a lateral note, the coefficient 0.118 theorizes that there is a positive correlation between lawful proceedings and behavior of Consumers. Coping up with law and avoiding unlawful practices helps a company to become more efficient with their operations and also save hectic amount of money in terms of legal issues. Customers also tend to have an undeniable reaction towards these companies and lean towards buying their branded products [19].

6. Conclusion and Recommendations:

The researcher identified various recommendations and marketing solutions for the footwear companies of Bangladesh which can help them to operate with more coordination and accomplish growth in the future. Throughout extensive research the author identified that international branches of BATA, BAY FOOTWEAR, APEX and LEATHEREX FOOTWEAR are more successful compared to their branches in Bangladesh more precisely due to currency exchange rates [20]. First of all these shoe companies need to adopt new technological changes in the market to achieve advancement and become more innovative with their products, operations, transaction and assemble of the resources which will gradually aid them to become more competent and procure competitive advantage in the market [27]. They can re-create their HR department and hire fresh University Graduates who have the knowledge to apply new techniques and identify more dependable ways to manage the business. Bangladesh origin shoe companies also need to become socially responsible and create eco-friendly products to establish a strong brand image [25]. These companies should rigorously motivate their marketing officers to conduct modern marketing research to find out the recent needs and wants of the customers and also reach for new advertising agencies to cope-up with latest advertisement trends that actually create an effective impression among their potential patrons [32]. They have to become more decentralized by opening more outlets outside the capital city of the country to reach more customers which will result an increase in volume of sales. Shoe companies might also extend their product line and create particular set of packages such as free money bags or belts with men formal shoes in reasonable prices to attract more working class people. By following this recommendations and suggestions the researcher believes footwear companies can achieve high rate of growth and sustain market leadership in the future [15].

7. Limitations of the study:

Although this research will be beneficial for the footwear companies there are certain limitations that cannot be controlled such as political changes, research on particular age groups, natural disaster and new strategies implementation by the competitors. The people who will endeavor this research work must keep in mind about the uncertainties and should also remember there is always risk involved in this particular industry as new emerging products are constantly penetrating the market.

8. Amplitude for Added Research:

The author identified that there is scope for supplementary research on the selective topic and the problems associated with this research. Researchers have various options to conduct further research such as on Green Marketing Strategies, Human Resource Strategies, Leadership and Organizational Culture associated with the footwear companies of Bangladesh. Furthermore more scrupulous research on broad audiences is also hypothetical in terms of understanding the percussion of promotional strategies on consumer behavior and management to clear out more dubioseness and confusion regarding the proposed problems.

References:

Available at: http://www.apexfoot.com/apex-foot-health-and-wellness/


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Dowry, Its Causes and Consequences: A Sociological Study of Dowry Harassment and Death Cases in Aligarh District of UP

Saira Salim

Abstract- Dowry refers to “the property, money, ornaments or any other form of wealth which a man or his family receives from his wife or her family at the time of marriage. Dowry is both a practice and a problem with Indian marriage” (Haveripeth, 2013). The practice of giving dowry was meant to assist a newly-wed couple to start their life together with ease; however, now it has become a commercial transaction in which monetary considerations receive priority over the personal merits of the bride. Dowry system has given rise to many socio-economic problems with very serious consequences. Numerous incidents of bride burning, harassment and physical torture of newly-wed women and various kinds of pressure tactics being adopted by the husbands/in-laws’ pressurizing for more dowry have compelled the social reformers and the intelligentsia to give serious thoughts to various aspects associated with the institution of dowry (Sachdeva, 1998). Government of India enacted “Dowry Prohibition Act” in 1961, which was further amended in 1985 to control this menace. In spite of this Act, the “give and take” phenomenon of dowry is practiced widely throughout India, irrespective of caste and class (Grantham, 2002). In many cases, when dowry amount is not considered sufficient, the bride is often harassed, abused and tortured (Singh, 2005). Dowry related violence and bride burning (dowry death) are only peculiar to our country and beside husband, his kin also join together in persecuting the bride as the dowry and related customs provide a good excuse to them for humiliating, insulting and even beating up of woman (Haveripeth, 2013). The bride is helpless in her new home and physically so powerless that she cannot retaliate against the coercive tactics or actions of other; not many women have the guts to divorce their husbands on the ground of frequent mental or physical torture since they have nothing to fall back upon in a traditionally and poorly developed country like India (Singh, 2005). Recent studies suggest a link between domestic violence and dowry demands. Wife abuse has been found to be higher when a husband and/or his family believes dowry payments are inadequate (Banerjee, 1999; Bloch and Rao, 2002). Suran et al (2004) in a study “Does Dowry Improve life for Brides” found that, in Bangladesh, married females who paid dowry at marriage “have a higher likelihood of reporting domestic violence compared to those who did not; in fact, paying no dowry is just as protective, if not more so, in terms of preventing abuse as the largest dowry payments”. Persons participating in dowry related violence are mostly mother-in-law and siblings of the husband and Gautama & Trivedi found that in a majority of cases the husband and the mother in-law of the victim played a leading role in planning and execution of violence against the bride. These crimes appear to be a product of socially structured expectations about dowry giving the inferior status of women and consequently the low bargaining power of the women and her parents; the growing urban consumerism among lower and middle class sections of the society as well as the lack of effective legal sanctions against such crimes (Haveripeth, 2013). Dowry related violence has been regarded as a universal phenomenon, cutting across all sorts of boundaries and is on continuous increase in India, it may be taken as a matter of grave concern that dowry harassment and death is one of the typical problems of Indian society (Singh, 2005). In this context it is necessary to understand the extent of dowry related violence and the resultant efforts made by the sufferers to stop control or overcome.

Index Terms- Dowry, Section 498A, cruelty, dowry related violence, dowry death

I. INTRODUCTION

For over a century, eradication of dowry has been a major item on the agenda of social reformers of all hues. In the last decade or so, it has perhaps received more attention than almost any other social issue yet; dowry is nowhere, near being eradicated in fact, it has flourished and spread through all levels of society (http://www.manushiindia.org/pdfs_issues/PDF%20files%2034/2%20Dowryto%20ensure.....pdf). The dowry system in India has a long history. To understand about the origin of dowry, we have to analyze the position of women throughout the ages. During the Vedic period, women were sufficiently educated and civilized. Marriage was not a social contract but a necessity in law and the married women enjoyed a place of dignity. Monogamy was the established system. Dowry system was prevalent in rich land lords only in the form of movable gifts. Widow Remarriage was also allowed during the period. During the Epic period, the condition of women had deteriorated considerably. The concept during this period was that women are the root cause of all evils and narrow mindedness. Polygamy and polyandry were also in existence during this period. According to the texts, the legal position of a woman was always that of a dependent. The unmarried daughter was under the control of her parents, the wife other husband and widow of her sons. Though a dependent, a woman might possess her own property in the shape of jewellery. The stridhan passed on to the daughter and not to son.

During the Sangam period, there was no statement of legal and social equality among the sexes. Manu stipulated that, “A women must be obedient upon her father in childhood, her husband in youth and upon her son in old age”. She should never be free. Introduction of child marriage at an early age resulted in
denial of educational right to women. Thus women’s inferior position throughout the ages was, not merely in the family and society, but also in matters of property right (Jayapalan 2002:12-16).

During the Medieval period the system of dowry had taken a positive root of great magnitude from 13th to 14th century. However the amount of dowry began to increase disproportionately because of the exclusiveness of marriage with one’s own sub caste. During the later period of Muslim rule, the position of women had changed. Birth of a daughter was considered as a bad omen. Women were supposed to stay within the four walls of their homes and denied education. Polygamy was now an accepted practice in our society. Purdahsystem also prevailed. Women’s right to Stridhan was recognized though, there were some difference of opinion as to what really prevailed. Women’s right to Stridhan was recognized though, was now an accepted practice in our society. Purdahsystem also prevailed. Women’s right to Stridhan was recognized though, there were some difference of opinion as to what really constituted as Stridhan. Women's exclusive right was only confined to “only a part of Stridhan comprising free gifts of affection”. The idea that they had a share in the property was gradually gaining ground. During the British rule, dowry system had grown up into the monstrous curse throughout the country. Under the burden of heavy taxes, peasant families were inevitably compelled to find cash where they could or lose their land. As a result, the dowry increasingly came to be seen as a vital source of income for the husband’s family. The British modified laws, especially those regarding land tenure and in that process, women became invisible and they became dependent on men. By 1850’s dowry became a way of showing the appreciation, afamily had for their daughter. During this period women were left without legal entitlements.

During the modern times, when India became independent, the Indian women were caught up in the shekels of socio-evils like dowry, sati etc. However, social reformers like Raja Ram Mohan Roy, Renade, Ishwar Chandra VidyaSagar and Mahatma Gandhi dedicated their lives to the abolition of these social evils like dowry, the fruitful result of their efforts were perceived first in Sind, called the Sind Deti – Leti Act in the year 1939. But this act however, failed.

After independence, however, the two states of Bihar and Andhra Pradesh enacted their own state laws, to stamp out the evil of dowry system. They defined dowry as “Any property or valuable security given or agreed to be given as consideration for marriage”. Giving and taking of dowry were made non-cognizable, bailable and non-compoundable. But these acts were not successful. In 1961, the dowry prohibition act was passed which made giving and taking of dowry, its abetment or the demand for it, has been made as an offence punishable with imprisonment with fine or both. This act was amended in 1984 and 1986 when the exploitation and suppression of women could not be checked. Thus Section 498A in 1983 and Section 304-B were incorporated in 1986 to deal with dowry-death. These sections have provided a tooth to the law. Today, dowry practice is a global phenomenon practiced by all people in India, with different religions; government is trying to eradicate the problem of dowry (Sharma 2006: 21-24).

II. DOWRY A SOCIAL PROBLEM

The last few years have witnessed an alarming increase in the number of cases in which married women are harassed, tortured, abused and driven to suicide in circumstances which are highly suspicious. As this cruelty or harassment and even deaths have come to be associated with dowry in popular parlance they have come to be called as dowry harassment and dowry deaths. In majority of cases the victim is often a young and a recently married women. The phrase ‘Bridaltorture’ and then ‘Bride Burning’ has come in vogue. The general public reacts vehemently against such in human acts and demands exemplary punishment to the culprit. But paradoxically enough, the culprit invariably goes unpunished taking advantage of some loopholes in the law. Sometimes the helpless young bride herself in sheer desperation resort to suicide from her hellish life. Rape and physical torture of young woman are common in most parts of the world, but bridal torture and burning appears to be an Indian phenomenon.

The major question that often strikes in the minds of the people about dowry torture that leads to bride burning firstly is, how common is this problem in our society? And what causes thein-laws and husbands to be violent to their brides or daughters in-laws? Since dowry related crimes and other forms of violence against women is a product of socio-cultural context such as types of dowry demand, socio-economic background of victims or of interacting families etc. there is a need to develop a theoretical framework by evolving concepts and theories to understand the problem of dowry torture and bride burning. An attempt has been made in this chapter to analyze the problem of dowry torture and deaths with a sociological back drop (Umar 1994:87).

Dowryrelatedoffencesunderthelaw: Till 1983, the Indian Penal Code 1860 did not contain any specific provision to deal with violence against women with in the matrimonial home and particularly dowry related offences. The guilty husband and the in-laws could be prosecuted under the general provisions of Indian Penal code relating to murder, attempt to commit murder, abetment to suicide, causing hurt, assault, or use of criminal force, outraging the modesty of a women, wrongful confinement and causing disappearance of evidence etc. The criminal law Amendment act, 1983 created an entirely new offence unknown to criminal law in India. Chapter XX-A entitled ‘of cruelty by husband or relatives of husband’ which contains only one section 498-A, was inserted in IPC to deal with persistent and grave instances of dowry demand and such offence was made punishable with imprisonment which may extend to three years. Despite the dowry prohibition act and section 498-A these laws could not handle the dowry related offences and the constant increase in dowry death attracted the attention of the concerned persons. On the recommendation of the law commission the parliament passed a new law in 1986 relating to the offence of dowry death by introducing section 304-B in the IPC. Such deaths were made punishable with imprisonment for a term which shall not be less than seven years but which may extend to imprisonment for life (Jaishanker & Ronal 2013:85)

The criminal law was amended to create special categories of offence to deal with dowry harassment, cruelty to married women and dowry death. The protection of women from domestic violence act 2005 includes actual abuse or the threat of abuse whether physical, verbal, emotional. It also covers harassment for dowry or any other unlawful demands. In 1983
domestic violence was recognized as a specific criminal offence by the introduction of section 498A of the Indian penal code.

Section 498A: Section-498A was inserted into the Indian penal code in 1983 (Umar 1994: 201). The object of this section 498A is to deal with a situation when coercion is used for demanding dowry after marriage by husband and in-laws. It also includes physical or mental cruelty. The wordings of this section are enough to apply to other situations of domestic violence” (Umar 1994: 186-190).

Section-304-B: -- (1) Where the death of a woman is caused by any burns or bodily injury or occurs otherwise than under normal circumstances within seven years of her marriage and it is shown that soon before her death she was subjected to cruelty or harassment by her husband or any relative of her husband for, or in connection with, any demand for dowry, such death shall be called “dowry death”, and such husband or relative shall be deemed to have caused her death.

Explanation - For the purposes of this sub-section, "dowry" shall have the same meaning as in section 2 of the Dowry Prohibition Act, 1961 (28 of 1961). Whoever commits dowry death shall be punished with imprisonment for a term which shall not be less than seven years but which may extend to imprisonment for life" (http://www.legalblog.in/2011/02/dowry-death-meaning-supreme-court.html).

III. HISTORICAL BACKGROUND OF DOWRY HARASSMENT

The beginning of the 19th century played an important role in degrading women. In India “family” has always been of prime importance. Marriage being an important social institution since Vedic period was biased against women. It was regarded as the social alliance between the two families instead of two persons. The bride was expected to serve her husband and his family and ensure their happiness and well-being. There was no question of her happiness, expectation, content. There were 3 main objectives of Hindumarriage: dharma, proja or procreation and rati or conjugal love (http://www.legalserviceindia.com/article/1336-Section-498-IPC.html).

The victimization of women in India starts from the time of their birth. Boys are preferred to girls. In most of the cases the birth of a girl child does not make even the parents of the child happy; they want the second child to be a son, the third to be a son and so on. Even if an educated woman gives birth to 2 or 3 daughters she is made to hang her head in shame. She is subjected to abuses and all sorts of ill-treatment especially by the in-laws. Many women have committed suicide being fed up with torture by mother-in-law and husband for being unable to give birth to a son for the family (Baruah 2004:13-14). Indian women are always viewed as an economic burden with in society and within family. The daughters are always treated as secondary due to the strong preference for son and their financial burden as high dowry cost. Deliberate discrimination against girl child takes several forms: nutritional denial such as inadequate breast feeding and early weaning, insufficient or delayed medical care, lack of attention causing emotional deprivation and insufficient investment to resources. All these have been documented as leading to excess mortality in the female child.

In the present context in our society, parents feel duty bound to plan and perform their daughter’s marriage. It’s considered a great dereliction of social duty if parents fail to perform this all important duty. A daughter is never considered settled if she is not married even if she has a well-paid high status job. The pressure is not only to settle her but to do so at the right age. The concept of right age has varied from time to time and community to community. For the urban educated middle class today, the right age begins soon after the daughter graduates when she is about 19 years old. By the time she crosses 26 years she is on the verge of losing out in the marriage market. Hence the desperation grows and the groom may have to be compensated with a higher dowry. Even if she has acquired more education or a better paid job these are not always considered efficient compensation for the age handicap (Reddy 2005:254).

In fact a woman’s education may actually increase dowry rate instead of reducing or eliminating it because a higher level of education implies that the women has been kept unmarried for a long period of time. The social undesirability of postponing a marriage for a woman beyond her late teens or early twenties reinforces the low value accorded to the education and economic self-sufficiency of a woman in Indian society. Frequently a woman is encouraged to pursue education only to the extent it places her “in the social strata of men who may be highly candidates for marriage”. A Woman who acquires an education with the goal of becoming self-sufficient is generally viewed as being either licentious or arrogant. Thus she is still discouraged and often prohibited by her family and in-laws from earning an independent income. One new element that has entered in to the marriage arrangement is that the demand or expectation of dowry is subtly conveyed through various channels like the intermediary and in some cases kins and friends to the bride’s parents (Paul 1986:10).

When marriage alliances are made both the parties take pains to display their status by describing at length their family connections and the amount of property owned. The socio-economic status and power of brother’s, uncle’s, grandparent’s, cousins all play an important role in determining the outcome of marriage negotiations. When the groom’s family insinuates the girl has a decent family background it’s an unmistakable hint at the status of the family. This enhances the likelihood of getting dowry of certain quantity and quality. Likewise the groom’s family displays its own connections and relatives and economic worth to hint that whatever is given should be commensurate with their status as they define it. These status descriptions affect the calculations of a particular dowry although dowry is to a large extent determined by the customs in a particular kinship group (www.manushi.in/docs/522.%20Dowry-to%20ensure….pdf). For the girls in societies like the Indian society marriage has an important aspect. As per the existing social traditions they have to permanently shift their residence to the home of their married partner leaving their parental home for good (Chitraset 2006: 151-152).

A daughter’s change of status and her transfer from one family to another has a strong cultural sanction. The formal
Their daughter marriage. The price tags attached to eligible dowries brought by them help parents to utilize a part of them in yield returns. If the groom has unmarried sisters in the family the earnings in educating their sons regard them as investments to has become expansive. Parents who spend a sizable part of their silver, the prices of which are rising almost every day. Education girl for additional dowry. In fact majority of the girl's parents are permanent obligation. The husband and his people thus assume the role of the reluctant acceptors of the girl's parents whom they assume they have helped out of a difficult situation of carrying the burden of their daughter for life and in return for their generosity they assume they have a right to demand compensation in cash or in kind. The custom of dowry has permeated all religions and social classes. It has spread to neighboring countries and is flourishing even among south Asian immigrants to western societies. Dowry has come to be identified as one of the key aspects of Indian women oppression (Rajkumar 2004:165-166).

IV. DOWRY RELATED VIOLENCE AND OTHER FORMS OF HARASSMENT

Violence against women is not a myth but a reality that exists and exists everywhere. The type, intensity, frequency and control of violence against women may vary from time to time or place but it's there. In our society though many cases remain unreported due to cultural norms, apathy, or ignorance. This may manifest themselves directly in feticide, female child killings, bride burning, dowry, murder, wife beating, and abduction, eve-teasing and verbal abuses. Thus violence can be defined as any "aggressive behavior of a person or persons, hurting body or positive regard or both of another person or persons is human violence." When analyzed: Aggressive behavior means vigorous behavior or action.

- A person means a victimizer either male or female.
- Hurting body means inflicting physical in fury.
- Positive regard means need to be loved or accepted by others as a person.

The last decade focused much attention on one specific group i.e.-women. The group is a majority one as more than half of the world population comprises of women. In spite of this dominant majority, the irony of fate lies here. The pathetic condition of women in society is itself an indicator of the low values set on women's lives and their suffering is very well in tune with the social system and life partner. The condition of Indian women is very much shocking. Limitations due to India's cultural and familial background, the social, economic and political conditions are a sore responsibility for women's oppressions. They are the victims of circumstances which persist in India from cradle to grave (Jha 1998:107-113).

The problem of crime against women is not new. Women in Indian society have been the victims of humiliation, torture and exploitation for as long as we can remember. No serious attempt was made to explain why the government and public alike have ignored for so long, the varied evidence that women are being greatly exploited in our society. The attitude of indifference and negligence can be attributed to 3 factors: lack of awareness about the seriousness of the problem, the general acceptance of man's superiority over women because of which violent acts against women are not viewed as violent, and the denial of violence by women themselves due to their religious values and social attitude. Laws and attitudes have been dictated by men so it suited them to perpetuate the image of the superior being. After 65 years of independence women of India do not enjoy a life free from torture (Giri 2006:179).
The atrocities committed on women can be divided into various groups: - physical violence. Physical violence may include assault, serious injuries or burns etc. Sexual violence means robbing the dignity of woman not only by indecent behavior but it may take the extreme form of rape, female genital mutilation etc. Verbal violence means indecency or use of abusive and filthy language against a woman or those near and dear ones. Social violence includes demeaning, disparaging and humiliating a woman or her parents. Emotional violence leads to internal deprivation of love and affection, coercion, sympathy and care. It also includes depriving her custody of children. Financial violence means depriving her of financial means and bare necessities of daily life also includes taking away the assets which a woman earns. Intellectual violence means deprive of rights to take part in decision making and decisions for pressing issues. Other forms of violence may include denial of education, access to health facilities, reproductive right's etc. (Sharma 2004:118).

First a definition of dowry related violence is necessary. Research in this area is based on official reports of cases that come to public attention. Therefore, uniform definition of dowry related violence will have consequences not only for estimating the extent, forms and causes of dowry related violence but also help the researcher to study the phenomenon to identify subjects and to draw samples from a much wider population of cases. Nominally violence can be defined as "an act carried out with the intention or perceived intention of hurting another person." The hurt may be emotional in fury or even material deprivation. This definition also includes harassment, cruelty as well as death caused by such behavior. Thus, persistent demands for dowry leading to oppressive conduct by the spouse and/or by the in-laws toward the woman resulting in her harassment death or in commission of suicide by her can be termed as dowry related violence (Roy 1999:806-810).

The most common form of harassment of a woman by her in-laws, unfolds in the form of taunts, threats which generally escalate to wife beating and even burning (Veer 2004: 203). The taunts flung at a daughter in-law do not relate to major demands for cash or items like video and electronic goods. Much more common are taunts regarding the number and quality of saris given to her, the quality of the wedding feast and the present's given to her by her natal family at various festivals. If the main motive was avarice if would be wiser for the in-laws to demand cash for themselves rather than grumble about the number of saris given to the bride. The whole process of constant humiliation is intended to demoralize a woman so that her feelings of vulnerability forces her to carve a place for herself in her in-laws house however degrading the terms she must accept. She is compelled to grovel before her husband and his family in order to seek precareous foothold. Thusa dowry demand are as little or as much related to greed as rape is to sexual satisfaction(www.manushi.in/docs/522.%20Dowry-to%20ensure.....pdf). Both are essentially forms of violence whose main purpose is to degrade and victimize a woman so that she retains desperate fear of disobeying the powerful.

Wife beating—The term dowry and dowry deaths have become synonymous with wife beating and domestic violence (Khanna 2009:156). It has become a key issue in practically all movements in which women are active. Dowry is one of the major reasons of domestic violence. Dowry not given or dowry not sufficient enough demands far more dowries etc. are some of the reasons cited by women for domestic violence. Money matters is another reason for violence; it’s more about the control over her income and assets. Her refusal to give money for reasons other than house hold expense may lead to violence. There are instances when man spends all his earnings on alcohol and gives nothing to the house hold, when a wife questions her husband she is beaten up. Extra-marital affairs and bigamy also lead to violence. Violence occurs when the wife refuses sexual advances of her husband on the pretext of other woman. Usually if the women of the house hold asserts her views on her husband’s it’s viewed as challenging the authority of male which is often taken as disrespect and needs to be punished by physical assault. In most cases of violence against women is always a primary actor either as a silent witness or as an accomplice to the crime. For instance in case of dowry death there is an involvement of mother or sister in-laws. Incase of domestic violence either�� accomplice of second wife or other women. Thus the list is endless (Kaushik 2007:169-171).

Mental torture of a wife is a covert phenomenon it may even be more devastating than the physical assaults. Taunting the wife, insulting her in the presence of children, guests and domestic help, and cutting off communication with her are common manifestations of mental torture (Giri 2006:185-186 ).

Confinement is isolating the woman in a room which is again another form of mental harassment. Often woman is locked in the room with no access to food and water. Threats include intimidation and cursing. Man threatens his wife of grievous assault, killing her or killing her children and parents in some cases threat is given for forced abortion.

Verbal abuse is a most prevalent form of domestic violence and commonly understood as scolding. This form of violence is often followed by physical violence. Physical abuse is beating with hands and fists, iron rods and sticks throwing her against the wall kicking hurling objects at her. There are instances when husband in rage has thrown boiling water on wife, poured kerosene to burn her etc. (Kaushik 2007:169-171). Wife beating, though a universal phenomenon existing throughages has been shrouded in secrecy, guilt and shame on the part of the victim. It’s only in the last decade that wife battering has been recognized as a social problem of major proportion. The death which occurs within the home is the ultimate manifestation of the violence suffered by most Indian women. There can be nothing more shattering for a woman than being battered by a husband who is supposed to love her and look after her and whom she trusts the most (Misra 2006:145).

The term dowry death as an over simplification of a far more complex social phenomena of power relationship within the family. Most of these women are harassed for a long time before they are murdered or driven to suicide and every woman who dies in her home there must be a million more that are beaten and harassed, economically deprived and mentally humiliated. Ram Ahuja has rightly pointed out that there is no woman who has not suffered at one time or harassment and humiliation, violence always shadows her sex. A woman’s life lies between pleasure at one end and danger at other end. The violence ranges from slaps and kicks to breaking of bones including physical and mental torture. Beatings may be simple or it may cause severe hurt in the
form of permanent impairment of limbs or leading to hospitalization. It may also involve the use of dangerous instruments and weapons. Under section 320 of I P C the following kind of hurts have been described as grievous:-

- Emasculation
- Permanent deprivation of the sight of either eye
- Permanent deprivation of the hearing of either ear
- Deprivation of any member or joint
- Destruction or permanent impairing of the powers of any member or joint.
- Permanent disfiguration of the head or face
- Fracture or dislocation of a bone or both or
- Any hurt which endangers life

The net effect of this provision is that beating simply by hand or by use of instruments or any dangerous weapons is a serious matter. Accordingly the punishment also extends to 7 -10 years with fine depending upon the nature of weapons used for commission of offence. The offence cognizable but bailable. However if grievous hurt is caused by dangerous weapons with a view to extort money after administration of stupefying drug the offence becomes non-bailable. While beating has been common among the lower and middle classes in recent years; it has become a widespread phenomenon in the middle and upper middle classes. Harassment of the wife and the daughter-in-law has become common with the sole purpose of extorting money as dowry (Srivastav 1985:31-33).

Several women’s organizations have been working with battered women. Narrating their experiences with battered women, the women from Saheli (1986) North Delhi felt that the matter of violence differs from one class to another. There is nothing private in a husband beating his wife as half the neighbourhood is witness to the act. The sympathies for the wife are according to rules established. If the husband is an alcoholic or a womanizer there is always a lot of sympathy for the wife and the neighbours often reach out and help the wife slapping her husband. But if they perceive the husband as a decent sort of man with no major vices the blame is usually laid on the wife basically because wife beating is considered legitimate. Very often no one else even in the house knows what is happening. The first time when a wife confides in a friend or relative it’s sealed with stunned silence and disbelief. One levelling point between all these classes is the attitude that the wife must have provoked the husband it could not be his entire fault which in other words is the overall acceptance of physical violence towards the wife. The experiences at the Saheli made it clear to them that (1) An odd slap or a kick now and then was not perceived as something major (2) the connection between the above and regular physical assault was not perceived (3) A lot of women who suffered physical abuse were willing to continue to suffer provided he would change his habits. From this they concluded that that woman had a very low esteem. Yet paradoxically somewhere in the subconscious all women who could talk about being beaten felt more humiliated by this act than any other form of subjugation and which finally broke down their resistance. It became the most painful aspect of their lives to talk about. Yet because they were convinced that this form of chastisement was natural for a man to use, it had to be accepted (Jesan 1998:6-7).

Many women who are battered loathe the battering but find it difficult to leave a terrifying situation. Shame is an important factor (Hirsch 2003:179). The battered wife feels ashamed to let people know about her situation. Like the rape victim the battered wife often feels that there is something wrong with her and that somehow she is responsible for the beatings. The girl is discouraged from frequently visiting her parents. Her isolation from her earlier natal source of support being complete her natal family is kept in the dark under the impression that all is going well and not having an inkling of what is going on. However most parents would rather see their daughters dead than have them get a divorce and return permanently to their parents’ home. Dowry acts as a supposed bribe to the son-in-law to keep the daughter who after reaching a certain age is totally unwanted in her parents’ home. (www.manushi.in/docs/522.%20Dowry-to%20ensure.....pdf). That is why a woman’s parents are always ready to meet with continuing demands made by the husband’s family provided he keep her in his house (www.manushi.in/docs/522.%20Dowry-to%20ensure.....pdf).

The natal family too offers little support as the parents are hesitant to intervene in the sanctity of the marital relationship or unwilling to take on the responsibility of a daughter who may wish to leave her husband. The parents of the dowry victim do not file a case against the in-laws during her life time but only upon her death and that too in order to avenge her death and retrieve the gifts. What is worse “the parents are all set to marry their next daughter with an equal amount of dowry to a boy of their choice” and this itself constitutes a form of violence (Bhattacharya 2004:60-61). It’s usually only when the woman is thrown out of her marital home after all attempts to placate her in-laws fail that her family will in desperation finally think of taking some action. Her parents only reluctantly take her back but her hold in their house remains precarious. She is there on sufferance but not by right. Part of the justification used by many families for their refusal to provide support to their daughter is that they have already done all that they could for her by giving her a dowry. Parents frequently therefore discourage daughters from leaving tyrannical husband’s because this will mean a loss of what they consider their investment. Hence their constant advice to her is to adjust to maltreatment.

In most cases of murder and maltreatment the women feels so weighed down by the expenditure under taken by her parents that she feels duty bound to present a smiling face to them and never let them know that their investment has proved a dismal failure. Their-laws take advantage of a girl’s parent’s unwillingness to take her back in to their home in order to blackmail them in to giving more and more money. Most parents justify their succumbing to these demands saying it was done for the daughter’s well-being. But it’s almost unheard of for parents to try to solve the problem by giving the daughter a shop or a house or capital to set herself up separately so that she does not have to put up with maltreatment. Thus the woman’s parents by putting additional resources in the hands of the groom’s family in fact enhance his power over her life and incite him to make
additional demand and tilt the power scales even further in his favor (www.manushi.in/docs/522.%20Dowry-to%20ensure.pdf).

Dowry in India today remains a compelling force in the life of Hindu families (Ghadially 2007:92-93). In fact marriages with dowry are continuing despite the dowry prohibition act of 1961 that made dowry illegal. However with the changing socio-economic structure dowry has changed shape and meaning to the point where Srinivas sees it as a modern monstrosity which people attempt to legitimize by linking it up with an ancient and respected custom. The earliest legislation to deal with the problem of dowry was passed in 1961. The act was however more a step to educate public opinion than to seriously deal with violence generated by dowry system. The legislation accordingly proved to be totally ineffective in dealing with the problem of dowry violence. By the end of 1970’s it became clear that the exploitation of women through giving and receiving of dowry was rapidly increasing in various sections of society. Incidents of dowry violence were reported almost every day in the media. It was in these circumstances that women organizations demanded sweeping changes in the law relating to dowry and dowry violence. The joint committee of parliament took evidence from a cross section of people including representatives of women’s organization and groups and suggested various changes in the dowry prohibition law. This dowry prohibition law was amended twice thereafter in 1984 and 1986 and significant changes were made in the act to make it much stronger and to give it depth. The punishment for giving and taking of dowry was increased to a minimum period of imprisonment for 5 years and a fine of not less than Rs. 15000 or the equivalent of the value of such dowry which ever was more. The demanding of dowry was also made punishable for a period of not less than 6 months which could be expended to a period of 2 years and a fine. Dowry was made cognizable and a non-bail able offence.

Women’s groups and others repeatedly pointed out that unless preventive steps were taken to curb dowry the law would be ineffective. The complaints against dowry were always made when the relationship between the parties had broken down or when dowry murder occurs. The 1986 amendment sought to provide preventive machinery by stipulating that the state government could appoint a dowry prohibition officer who would be responsible under the act to prevent the taking, abetting or demanding of dowry and to ensure that provisions of the act are complied with. In spite of these amendments dowry still remains a widespread phenomenon. If dowry is to be curbed it’s essential that various other steps are also taken to improve the status of women and make them economically independent. The amendments relating to dowry violence introduced two new types of offences in the Indian penal code 498A and 304B.

Before the year 1983 there was no specific legal provision pertaining to violence against women at domestic front. Husbands guilty of committing violence on their wives could be convicted under general provisions relating to murder, causing hurt, abetment to suicide or wrong full confinement. These general provisions under criminals law does not take in to account the specific situation of women facing violence within the confines of home as against assault by an outsider or a stranger. Therefore an amendment was made in 1983 which

added section 498A to chapter xvi IPC. Although, the aim of this amendment was to deal with dowry harassment. In this law the word dowry was used as a necessary condition to define cruelty. It therefore applies widely to situations of domestic violence. It recognizes the fact that offences committed with in the privacy of home by a person on whom a woman is emotionally, financially social or otherwise dependent needs to be dealt at different plane. It makes violence perpetrated by husband and in-laws a cognizable and non-bail able offence and enable a woman to take preventive steps before such violence leads to her death (Ghadially 2007:92-93).

V. WHAT IS SECTION 498A OF THE INDIAN PENAL CODE?

Chapter xx-A of the Indian penal code 1860 which was amended in the year 1983 refers to “cruelty by husband or relatives of husband and includes section 498A”. Section 498A states “who ever being the husband or relatives of the husband of a woman subjects such woman to cruelty shall be punished with imprisonment for a term which may extend to 3 years and shall also be liable to fine.

Explanation: For the purpose of this section cruelty means:- Any willful conducts which is of such a nature as is likely to drive the women to commit suicide or as to cause grave injury or danger to life limb or health (whether mental or physical) of the women. Harassment of the woman where such harassment is with a view to coercing her or any person related to her to meet any unlawful demand for any property or valuable security is on account of failure by her or any person related to her to meet such demand (Sharma 2007:68). The increasing number of dowry deaths is a matter of serious concern. The extent of the evil has been commented upon by the joint committee of houses to examine the working of dowry prohibition act 1961, cases of cruelty by the husband and relatives of the husband which culminate in suicide or murder of the helpless women concerned constitute only a small fraction of cases involving such cruelty. It’s therefore proposed to amend the Indian penal code, the code of criminal procedure and the Indian evidence act to deal effectively not with cases of dowry deaths but also cases of cruelty to married women by their in-laws. The offence shall be cognizable if the information relating to the commission of an offence is given to the officer in charge of a police station by the victim or by relative of the victim. The Indian Evidence act 1872 is being amended to provide that where a woman has committed suicide within a period of 7 years from the date of her marriage and it’s shown that her husband or any relative of their husband had subjected her to cruelty the court may presume that such suicide had been abetted by her husband or any relative of her husband (Sharma 2007:69-70).

Salient features of 498A: This is a criminal law that deals with issues that mostly takes place within closed walls. It deals with cruelty by husband or relatives of husband towards the wife. Cruelty or harassment is considered as a willful conduct with a view to meet unlawful demand. This offence is cognizable, non-bail able, non-compoundable and triable by judicial magistrate of first class. It’s specified as non-compoundable. However only the high court can give permission for compounding the case in exceptional situation (Shirwadkar 2006:138).
Cruelty under the matrimonial law: Cruelty began as a sort of crime against grounds for dissolution of marriage i.e. cruelty is a ground for separation under the Hindu marriage act 1955 (Sharma 2007:73). In AshwiniKumar Sehgal vs. Swatantara Sehgal the court observed cruelty in such cases has to be of the type which would satisfy the conscious of the court to believe that the relation between the parties had meliorated to such an extent due to the conduct of one or the spouses that it has become impossible for them to live together without mental agony, torture or distress. It further said that cruelty as a ground for divorce under section 13 (1) of Hindu marriage act, is aconduct of such type that the petitioner cannot reasonably be expected to live with the respondent. Under the Hindu law, intention or motive is not an essential element of cruelty. The act or conduct constituting cruelty need not be always direct it may be inindirect form as well. When the wife is ill treated by the members of the family and the husband stoodidlyinstead of saving or protecting his wife it also amounts to cruelty on the part of the husband. Cruelt y is divided into twoparts – physical and mental cruelty. Physical Cruelty: violence by one spouse to another resulting in injury to body, limb or health or causing reasonable apprehension of the same have been traditionally considered as cruelty. In fact, this is the original meaning of cruelty, what acts or physical violence will amount to cruelty will differ from case to case depending upon the susceptibility and sensibility of the party concerned. In Kaushalayav.wisakhiram the husband had been ill-treating his wife and beating her regularly. In this case the Haryana High court observed that according to the standards of all civilized world, these acts would constitute cruelty even though injury might not be serious so as to require the medical treatment (Sharma 2007:74). Mental Cruelty: In Avinash Prasad vs. Chandramohini, the Allahabad high court has held that, when the wife voluntarily deprives her husband cohabitation for a long period of time, it amounts to cruelty (Sharma 2007: 73-74). Mental cruelty can broadly be defined as “that conduct which inflicts upon the other party such mental pain and suffering as would make it not possible for that party to live with other”. It's not always necessary that a code of conduct be deliberately undertaken for the purpose of causing mental pain and suffering, in order for it to constitute cruelty. Act of alleged cruelty, may be judged by the effect produce and not by the motive provoking them. However cruelty may consist of remarks, statements, language or words that render the life of the spouse burdensome even if no personal violence is inflicted or threatened.

Words uttered without justifiable cause and for the purpose of inflicting pain or words tending to wound the feelings to such a degree as to affect the spou see’s health or cause grave and weighty mental suffering constitute cruelty. Permitting those under ones authority to conduct themselves towards one’s spouse in a way that seriously impairs the health of the person constitutes cruelty (Kapoor 2002:70-71).

Sexual difficulties such as denial by the spouse to have sexual intercourse against the will of the wife may lead to cruelty against the wife. Acts of excessive sexual intercourse having ill effects on health motel or physical of the wife may amount to cruelty. It was held that mere consumption of alcohol by the husband may not ordinarily be a reasonable excuse for the society but when it’s coupled with violence may be sufficient justification for her refusal. Causing physical hurt to his wife, obstinate insistence that the wife must eat meat and drink wine cumulatively constitutes cruelty. Illiteracy or low educational level is not an independent ground for matrimonial relief though education has an important bearing on the total personality of women. Illiteracy coupled with an act affecting the health mental or physical of the spouse may amount to cruelty.

Shri S.S. Chahar in his article “Matrimonial cruelty: Additive of new species” says that the nature of employment, job satisfaction and income as a correlate of employment are related to marital happiness in a family (Srivastav 2005:162). Unemployment results in stress in families and leads to violence between spouses. Unemployment parse is not cruelty under the Hindu marriage act 1955 denial or inability to provide proper food and clothing to the wife may however amount to cruelty (Srivastav 2005:162).

Cruelty is an abstract concept; there is no specific definition or explanation given by any jurist. Cruelty can be of different forms such as mental, physical, direct or indirect, intended or unintended. It also depends upon different factors and circumstances such as social-cultural background of the woman, mental and physical conditions, etc.

Few instances of cruelty as a social evil in modern era:

- **Slow starvation**: -is cruelty: The wife was compelled to do all the domestic works single handed. She was ill-treated and subjected to physical assault when she protested. She was not getting sufficient food and it resulted in slow starvation, thereby giving an emaciated look, to meet an unlawful demand of money. When she committed suicide cruelty stood proved in a court of law.
- **Repeated demands of dowry amounts to cruelty**: If repeated demands of dowry are made and harassment is meted out to a woman, who may be physical or mental, it is an act of cruelty.
- **False allegations in litigation amounts to cruelty**: The wife was subjected to a series of malicious and vexatious litigations in which extremely hurtful and offensive accusations were leveled against the wife of a sense of vindictiveness and wherein she was humiliated and tortured through the execution of search warrants and seizure of her personal property. These very acts when repeated and carried on constitute cruelty of an intense degree.
- **Repeated taunts calling her ugly and mal treatment is cruelty**: The wife was ill-treated from the next day of marriage and she was repeatedly taunted and maltreated and mentally tortured by calling her ugly etc. This amounts to cruelty, mental torture for any bride.
- **Neglect by husband also amounts to cruelty**: The act of the husband was only that of disregarding his duty to provide the wife and the child elementary means of sustenance while he himself was squandering his earnings on gambling and other vices and was starving his wife and infant child to death (http://www.academia.edu/9531210/A_Doctrinal_Research_on_Section_498a_IPC_1860_-A_critical_Analysis).
Thus IPC -498A is-
- Cognizable –the accused can be arrested and jailed without warrant or investigation
- Non compoundable-the complaint cannot be withdrawn by the petitioner.
- Non Bail able- the accused must appear in the court to request bail (Sharma 2007:74).

Section406 Criminal Breach of Trust: In order to understand, the concept of criminal breach of trust, in reference to offences relating to dowry, it’s necessary to understand Stridhan. “Any property given to a woman before, during and after her marriage, in connection with her marriage is considered as her Stridhan. Who so ever, whether the bride groom, his parents or his relatives or any other person, has received the dowry must hold it in trust for his bride. He must transfer it to her within the stimulated period of three months. If the women dies, with in a period of seven years of marriage, then the property would go to her children and if there are no children, then to her parents. If he does not do so, he will be guilty of dowry offences under section - 406.

Cruelty no abetment to suicide:Incases of abetmenttosuicide (www.thehindu.com/.../cruelty-no-abetment-to-suicide/article), there must be proof of direct or indirect acts of incitement. The mere fact that a man was cruel to his deceased wife is not enough to warrant conviction the Supreme Court has held. “Merely on the allegation of harassment, conviction in terms of section 306 IPC (if a person commits suicide whoever abets in it shall be punished with imprisonment of either description for a term which may extend to 10 years and is also liable to fine) is not sustainable,” said a bench consisting of justices ArijitPasayat and D.K Jain of Supreme court”.

Section 107 defines general abetment,” A person abets in the doing of a thing when he instigates any person to do that thing or engages with one or more persons in a conspiracy for the doing of that thing.” These things are essential to complete the abetment as a crime. In the instant case,KishoriLalvs. State Of M.P on 19 June, 2007, Raj Kumari committed suicide in her matrimonial home on August 31 1982 following harassment by her husbandKishoriLal, according to the prosecution. The trial court sentenced him to 5 years imprisonment. His appeal to reduce sentence was dismissed by the Madhya Pradesh high court. Allowing his appeal against this Judgment, the bench accepted Kishorilalscontention that there was no evidence to reduce sentence was dismissed by the Madhya Pradesh high court. Allowing his appeal against this Judgment, the bench accepted Kishorilalscontention that there was no evidence to show that he was in any manner responsible for the suicide by Raj Kumari. Further the allegation of torture made by her mother related to an incident which occurred 4-5 years prior to the suicide. There is ample evidence on record that the deceased was disturbed because she could not give birth to a child. The deceased was upset at this, according to the statements by 3 prosecution witnesses. If the back ground facts are analyzed, it’s crystal clear that the prosecution has failed to establish its case; the bench said and set aside the impugned judgment (www.thehindu.com/.../cruelty-no-abetment-to-suicide/article).

TheSupreme Court of India has ruled that the grooms and future in-laws will face the charge of demanding dowry if a proposed marriage fails to be solemnizing because the girl’s parents were unable to pay (http://www.dnaindia.com/india/zreport-dowry-law-applies-before-marriage). Adding teeth to the anti-dowry legislation the apex court said “It’s not necessary that the law applies only when the marriage has taken place but that it becomes active the moment the two parties start a dialog for marriage.

“The definition of the expression, “dowry” in section-2 of the dowry prohibition act cannot be confined merely to demand of money, property or valuable security made at or after the performance of marriage” a bench of justices ArijitPasayat and Ashok Kumar Gangly said. The bench said,“ demand of money property or valuable security made to bride or her parents or other relatives by the bride groom or his parents or other relative or vice versa would fall within the mischief of “dowry” under the act even if the demand is not properly referable to any legally recognized claim and is relatable only to the consideration of marriage.”

“The ruling which widens the scope of dowry prohibition law came in an appeal filed by a “husband”, saying, that he couldn’t be charged with cruelty for demanding dowry as he had never married the woman who made the charge. The Supreme Court rejected husbands’ plea that the “Victim woman” should establish that she was his legally married wife. It wondered if, “a person who enters into a marital arrangement should be allowed to take shelter behind a smokescreen.”

“Such legalistic niceties would destroy the purpose of the anti-dowry law provisions and would encourage harassment of a woman over money, the bench said”. The supreme court said that it would be appropriate to construe the expression 'husband' to cover a person who enters into a marital relationship and under “such proclaimed or feigned status” subjects the women to cruelty under section 304 B or 498-A(http://www.dnaindia.com/india/report-dowry-law-applies-before-marriage-). “Whatever the legitimacy of the marriage itself”.

VI. LIMITATIONS OF SECTION- 498A

The highehand behavior of the laws and the breakup of the marriage have another side. Lodging of cases with the crime against women cell may not be genuine. Matrimonial discords unconnected with dowry demands or dowry related harassment are often given the colour of dowry by the wives to get even with their husbands. A critical study of the section 498A reveals that a provision which was originally designed to protect the bride from being harassed and physically tortured by the husbands or relatives unfortunately has been abused to hassle the husband and his family. The Supreme Court in one of its rulings said that -

But by misuse of the provision (IPC, 1860 498A - Dowry and Cruelty Law) a new legal terrorism can be unleashed. The provision is intended to be used as a shield and not an assassin’s weapon. Section 498A IPC, 1860 sometimes said to be gender-based law because recent study reveals that the provision provides protection only to women in the fight against husband and his relatives. A number of cases have been filed in the police station which forms the basis for the official statistics of dowry harassment, which otherwise implicates that only the woman are entitled to file harassment cases with an unlimited scope of fabricating stories and lies without even undergoing any penalty

www.ijsrp.org
to pay compensation or any kind of damages (http://www.academia.edu/9531210/A_Doctrinal_Research_on_Section_498a_IPC_1860_-_A_critical_Analysis). The limitation of the law that emerged here are of 2 kinds -- Legal and Socio-cultural.

Legal - Due to certain inherent deficiencies of the section such as the absence of guide lines for protection of the victim, the law failed in providing protection to woman. Due to the absence of supportive law cruelty of less gravity other than danger to life could not get proved. The gap between complaint and a genuine case was unbridgeable. As the law deals with issues within the four walls getting proof was the most difficult part.

Socio-cultural - The inequality between men and women in Indian society is deep rooted and just one piece of law is insufficient to eliminate or change social evils. Cruelty or harassment between the relationship of husband and wife was insufficient to eliminate or change social evils. Cruelty Indian society is deep rooted and just one piece of law is routine matter. This was reflected in the stereotyped writing of this section received least priority and was also treated as a burden to their already busy schedule. Hence filing a case under police department considered this a family matter and an extra attitude of the implementing machinery particularly the police.

The biases and prejudices towards the victim it could not be proved due to the accused. So although the accused had committed cruelty and resulted in making the case more weak leading to acquittal of the demand of dowry could not be proved in many cases. This though that was not the fact in each case. During the court proceeding and the cross-questioning by the magistrate the demand of dowry could not be proved in many cases. This resulted in making the case more weak leading to acquittal of the accused. So although the accused had committed cruelty and harassment towards the victim it could not be proved due to the style and pattern of writing FIRS. The biases and prejudices and attitude of the implementing machinery particularly the police department as well as lawyers have affected adversely. The police department considered this a family matter and an extra burden to their already busy schedule. Hence filing a case under this section received least priority and was also treated as a routine matter. This was reflected in the stereotyped writing of FIR. The weak presentation in FIR ultimately impacted the verdict in favor of the accused party (Shirwadkar 2006:142).

VII. MISUSE OF SECTION 498A

IPC section 498A was originally designed to protect married women from being harassed or subjected to cruelty by husbands and their relatives. This law was mainly aimed at curbing dowry harassment. Unfortunately this law has been misused to harass men and their families rather than protect genuine female victims of harassment (http://www.legalserviceindia.com/article/l336-Section-498-IPC.html).

In the wake of modernization, education, financial security and new-found freedom, the radical feminist lobby can however use 498A as a weapon. Many unfortunate husbands and in-laws have become victims of their vengeful daughters-in-law. Most cases where section 498A of IPC is invoked turn out to be fabricated as they are mere blackmail attempts by the wife or her close relatives, when faced with a strained marriage. In most cases of section 498A of IPC, the complaint is followed by demands for huge sums of money to settle the case out of court. Over the last two decades or more of criminal law reform, a common argument made against laws relating to violence against women in India has been that women should not misuse these laws. The police, civil society, politicians and even judges of the High Courts and Supreme Court of India have offered these arguments of the “misuse” of law strongly. The 2003 Malimath Committee report on reforms in the criminal justice system also notes, significantly, that there is a “general complaint” that section 498A of the IPC is subject to gross misuse; it uses this as justification to suggest an amendment to the provision, but provides no data to support the contentions or to indicate how frequently the section purports to being misused.

It is important therefore that such “arguments” are properly responded to, and that there is a clearer and properly documented picture of the impact of criminal provisions that were enacted to protect women (www.ncbi.nlm.nih.gov/pubmed/22403123).

Conclusion:

It may be concluded that dowry a social evil exists in the society. Society continues to perpetuate the difference between a girl and a boy for the purpose of marriage, and it is this distinction, which makes the dowry system, thrives. It is very sad, that in our society, a female is considered a burden to a family or a liability for her parents. She is considered as a weaker section in our society. If we locate the origin of dowry we find that during the ancient period the dowry system was unknown. Vedic period was the golden period of women. Since marriage was considered essential for girls. During marriage the ritual of kanyadaan was an essential aspect, ‘dakshina’ in the form of gold coin and cash was given to the groom. All this was done out of love and affection. After the Vedic period ‘Smriti’s’ and ‘Manu Smriti’s’ pictured women in subordinate position to men. Her educational rights were denied and then she was considered as a burden. Later with the growing pressures of the Islamite’s upon India, position of women had further deterioted. They were to live in purdah. Her entire rights were snatched. She only retained her right of stridhan. Later the British had invaded India, they imposed taxes. As a result the position of women had further meliorated. Great reformers like Gandhi, Raja Ram Mohan Roy etc. fought for women freedom. It was only after 19th century that women freedom and unity movement took momentum. After a lot of struggle in 1961, legislators passed the dowry prohibition act. In order to make it more effective and deterrent it was amended twice in 1984 and 1986 (Sharma 2007:164-165).

The effects of dowry system are many and varied but in almost all cases it is the girl’s side which has to face the repercussions while the boy’s side walks away from the issue unharmed, with their heads held high. When demands for dowry are not met, the bride is subject to torture, and often even killed. Most of the dowry deaths occur when the young women, unable to bear the harassment and torture, commit suicide. Most of these suicides are by hanging oneself, poisoning or by fire. Sometimes the woman is killed by setting her on fire which is known as ‘bride burning’ and is disguised as accident to avoid criminal charges and punishment. Today dowry is not the innocent practice that it started out as but has turned into a social menace that cannot be reverted back to its original form; hence it must be eradicated from our society.
Thus it is one of the most difficult and serious challenges to the present day society. Such a complex problem requires an integrated social endeavour to successfully overcome it. It has to be fought on various fronts, legal, social, educational, cultural and political. So many legal laws, penal laws etc. are available to check this phenomenon. So many anti-dowry processions and demonstrations are organised by voluntary groups. But this evil practice continues on unabated (Chitrasen 2006:190).

REFERENCES


WEBSITES

[20](http://www.manushiindia.org/pdfs_issues/PDF%20files%2034/2.%20Dowry%20ensures.....pdf).
[22](http://www.academia.edu/9531210/A_Doctrinal_Research_on_Section_498a_IPC_.pdf).
[23](www.thehindu.com/.../cruelty-no-abetment-to-suicide/article).
[27](http://lawcommissionofindia.nic.in/reports/report.pdf).

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A Review on Noises in EMG Signal and its Removal

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Abstract- Electromyography (EMG) is the study about the function of muscles, and today it have many applications in biomedical and clinical purposes. The EMG signal contains two sources during the myoelectrical simulation which are the useful electrical response of the muscles and the noise in the signal. The noises can occur from either technical sources (power line noise) or from biological sources (ECG). The noises in the system must be carefully studied, as this will interrupt the analysis of the muscular activity. This paper discuss about various types of noises that affects EMG signal and also some of the basic noise removal techniques.

Index Terms- Artifact , Electrodes, EMG, Noise removal.

I. INTRODUCTION

Electromyography (EMG) is a process of recording the electric activities of muscles. It is used to assess the health of muscles and nerve cells. Today it is used in many applications and most commonly for research purposes. When the muscle fibres contract, it generates a small electric current, which can be measured using EMG. It will convert this electrical signal into graphs, sounds or/and numerical values. The signal is known to be Electromyogram and it can be measured using two techniques. There are invasive methods in which the electrodes like needle electrodes are inserted into the person’s body and non invasive method in which the surface electrodes are used to collect the EMG from the person’s facial tissue. Electrodes are used to measure the electric current generated due to the muscle contraction. The muscle activity is measured using electrodes. It converts the ionic currents generated by the muscle contractions into electric currents so that it can be easily be used by electronic circuits. In both engineering and medical fields, EMG is a very useful signal that have a wide range of applications. The different conditions of human body can easily be understood from accurately recorded EMG signal. But like any other signal, EMG signals are also susceptible to various types of noises. EMG contains mainly two sources, which are muscular electrical activity and artifacts. When passing through various tissues, EMG signal acquires various noises. Noise is the unwanted electrical signal in an EMG signal. This noise and artifacts in the signal is a serious issue to be considered, as this will adversely effects the quality of the signal. Also the analysis of EMG signals are difficult due to this. So a filtering is done on the received signal inorder to remove the unwanted signal before it is being used by the system. Thus the signal to noise ratio can be improved by reducing the noise in the signal. Several filters like low pass filter, high pass filter and notch filter can be used for this purpose. Apart from these, there are several other techniques.

II. ELECTROMYOGRAPHY

Electromyography is the process of recording the electrical potential from the muscles. The electrical potential is represented in the form of time varying signal.

A simple model of the EMG signal \[1\]:
\[
x(n) = \sum_{r=0}^{N-1} h(r) e(n - r) + w(n) \tag{1}
\]

Where, \(x(n)\) is the EMG signal, \(e(n)\) is the firing impulse, \(h(r)\) represents the MUAP, \(w(n)\) is the zero mean additive white Gaussian noise and \(N\) is the number of motor units firing.

EMG is also called as myoelectric signal (MES)\[2\]. It provides very important and useful information of neuromuscular activities. EMG signals are non stationary, non linear and complex signals. The information from the EMG is extracted from the features taken from it. For that there are several feature extraction techniques available.
The muscle movement is made under the control of our brain. Thus the electric activity of muscles are very closely related with the nervous system. An action potential is produced from the brain which passes through the nerve fibres. This action potential that passed through the nerve fibres will stimulate the muscle fibres. Motor neurons transmit electrical signals that cause muscles to contract. This causes the movement of the muscles. The electric potential from the muscles which is represented in the form of time varying signal is known to be the EMG signal.

III. NOISES IN EMG SIGNAL

The range of the EMG signal amplitude is between 0-10mV. When passing through various tissues, EMG signal is contaminated by various noises. It is very important to understand the properties of these unwanted electric signals. We can classify the electrical noises affecting the EMG signal into the following:

A. Inherent noise in electronics equipment

This type of noise is inherent in all electronic equipments. This noise cannot be eliminated. This can only be reduced by using components of high quality and using intelligent circuit design. It have frequency components in range from 0 Hz to several thousand Hertz. An adequate signal-to-noise ratio can be acquired when the EMG signals are recorded using the silver/silver chloride electrode. This is electrically very steady. As the electrode size increases, the impedance decreases.

B. Ambient noise

The main source of this noise is the electromagnetic radiation. The amplitude of this kind of noise will sometimes one to three times greater than the desired EMG signal. The surface of human body is constantly exposed to electromagnetic radiations. It is not that easy or is impossible to avoid this exposure on the surface of the earth. Power line interface (PLI) is the ambient noise causing from the radiation of power sources of 60Hz or 50Hz. If the frequency of this interference is high, then it can be removed by using a high pass filter. It is necessary to realize the nature of the EMG signal, if the frequency content of PLI is within the EMG signal.

C. Motion artifact

The frequency range of this type of noise is normally between 1-10 Hz. The voltage range is comparable to the amplitude of the EMG signal. The information is distorted when motion artefacts are introduced into the system. This causes irregularities to the data. This is mainly due to the changes in the muscle due to relative motion. There are chances that the electrodes can move from the skin with respect to each other. Also, when the muscle is activated, the length of muscle gets decreased. Thus electrodes will cause movement artefacts. The main sources of this artifact is electrode interface and electrode cable. Proper design of the electronic circuitry is the only way to reduce this artefact. The motion artifact can be removed significantly by using recessed electrodes. In this, between the surface of the skin and the electrode- electrolyte interface, a conductive gel layer is applied.
**D. Inherent instability of signal**

This is affected for signals with frequency components ranging between 0-20 Hz. The EMG signals are quasi-random in nature. Firing rate of the motor units affect the signal and hence they are unstable. This unstable nature causes noise. The information in the EMG signals are changed with the number of active motor neurons, motor firing rate and mechanical interaction between muscle fibres.

**E. ECG artifacts**

The process of recording the electrical activity of heart is referred to as the electrocardiography. The ECG is an interfering component in the EMG signal taken from the shoulder girdle, which is known as ECG artefact. The EMG taken from the muscles in the trunk are often gets affected by ECG artefacts. The EMG electrode placement is an important factor that determines the extend of ECG contamination in EMG signal. As the frequency spectra of ECG and EMG signals gets overlap and also as the characteristics such as non-stationarity and varied temporal shape are relative to each other, the removal of ECG artefacts from EMG signals are so difficult.

**F. Cross talk**

It is a type of noise occurs when an EMG signal that is not desired to monitor at a point of time gets interfered with the desired signal to be monitored. This contaminates the signal and will cause misinterpretation of the information. Even though this can be due to various parameters, by carefully choosing the electrode size and inter-electrode distances, this can be minimized.

**G. Electrode contact**

The electrode-electrolyte-skin contact will influence in the signal to noise ratio of an EMG signal. So the skin needs to be get ready before the recording of EMG signal so as to ensure the proper electrode-skin contact.

**H. Transducer noise**

This noise is produced at the electrode-skin junction\[5\]. Electrode converts the ionic currents generated by the muscle contractions into electric currents. So this can be easily stored in either analog or digital form as a voltage potential. The main two noise sources are DC voltage potential and AC voltage potential. The impedance effect is the main cause for this noise and this can be decreased by using Ag-AgCl electrodes.

**I. Baseline shifts**

The EMG rest-line remains at constant zero and the regular EMG burst returns to zero within a few milliseconds\[6\]. When the cables shake too much, there is a visible shift of baseline which is greater than 5ms indicating the artefact. This problem can be solved by correct fixation of electrodes.

The factors affecting the EMG signal can mainly be classified into three basic categories.

1) **Causative factors**: It affects the signal directly. This can be classified into extrinsic and intrinsic factors. The extrinsic factors are related to the electrode structure and its placement. Intrinsic factors are due to the physiological and anatomical factors which depends on the number of active motor units, blood flow, amount of tissue between the surface of the muscle and the electrode, etc.

2) **Intermediate factors**: These are physical and physiological phenomena that are affected by one or more causative factors. This can be due to band-pass filtering of the electrode alone with detection volume, superposition of action potentials of the EMG signal, etc. Intermediate factors can even cause from the crosstalk from nearby muscles.

3) **Deterministic factors**: Intermediate factors are the cause for deterministic factors. There is a direct connection on the information in the EMG signal with the number of active motor units, motor firing rate and mechanical interaction between the muscle fibres. Also the amplitude, duration and shape of motor unit action potential are causes for this.

**IV. NOISE REMOVAL TECHNIQUES**

The electromyographic signals are influenced by various factors including muscle anatomy and various physiological process and also by many external factors \[7\]. So the EMG signals are susceptible to various noises. They are interfering voltages that causes distortion to the measured signal. There are some inherent noises in the system that degrades the performance of the system. It is impractical or even impossible to extract the useful information from the EMG signal when the signal to noise ratio value is very poor. There are several noise removal techniques used to reduce the noises in EMG signal.

**A. Low pass differential filter**

The low pass differential (LPD) filter is widely used in EMG signal processing. The filter is implemented in time domain as

\[ y_k = \sum_{n=1}^{N} (x_{k+n} - x_{k-n}) \quad \text{...............(2)} \]

Where \( x_k \) is the discrete input time series and \( y_k \) is the filtered output. \( N \) is the window width. This \( N \) is used to adjust the cut-off frequency.

There are some drawbacks in this method such that in low signal-to-noise ratio conditions, the high frequency noises will be noticeable. Also, as the LPD filter is not ideal low pass filter, there will be leakage of energy frequency out of the filter pass band. So there are chances that high frequency noise gets pass through the filter. Apart from these disadvantages, the main advantage is that the LPD filter is easy to implement and also is fast for real-time applications.
B. Adaptive noise cancellation

This technique is used to reduce the effect of noise on the signal adaptively, so as to obtain the desired signal. Adaptive noise cancellation is an alternative technique of estimating signals corrupted by additive noise or interference. The 50Hz and 150Hz components are signals localized on frequency band of the EMG signal. Different digital filtering techniques can be used to eliminate them. Least mean square (LMS) algorithm is the basis for adaptive noise cancellation. It requires a reference input signal which is correlated with the interference signal. From the noisy signal, the reference input is adaptively filtered and subtracted. A fixed delay is inserted in the reference input and this delay must have a sufficient length to cause the EMG signal components in the reference input to become decorrelated from the primary input. When a signal is corrupted by a noise and resulted in a corrupted signal, the algorithm for adaptive noise cancellation will evaluate the parameters for the filter to attenuate the unwanted components.

LMS filter based technique will find out the filter coefficients which minimizes the mean square of the error. The error is the difference between the desired signal and the error signal. The undesired 50 Hz component can be attenuated by this method. As EMG signals also have 50Hz components, it is impractical to practically eliminate the noise completely.

![Figure 2: Adaptive Noise Canceller](image)

C. Signal filtering based on wavelets

Wavelets can be used for noise removal from the corrupted signal. The denoising of the signal involves signal decomposition, detail coefficient thresholding and signal reconstruction. In signal decomposition, both a wavelet prototype and decomposition level (N) are selected and the wavelet prototype and the decomposition level (N) is performed. In detail coefficient thresholding, for each level from 1 to N, a threshold is selected and soft thresholding is applied detail coefficients. In the signal reconstruction, the signal denoising is estimated by using the original approximation coefficients of level N and the modified detail coefficients of levels from 1 to N.

V. CONCLUSION

EMG signals have a wide range of application in many fields. Like any other signal, this signal is also disturbed by various types of noises. The removal of noise remains a vital factor for the analysis of the undeterministic signals. The various noises in EMG signal and some of the basic noise removal techniques are studied. In Adaptive filter system, it supports to provide stable system performance. The low computational complexity of LMS algorithm is an advantage of this technique. Also Adaptive Filters and LMS algorithm does not need statistical information like auto correlation for noise cancellation. LMS algorithm is easy to implement and is
mathematically less complicated. There are several types of noises and we cannot completely eliminate all these noises. We can only reduce its effect in the system by using these techniques.

REFERENCES


AUTHORS

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**Abstract** - The main challenge facing high bit rates optical communication systems is their tolerance to linear and nonlinear fiber impairments. In this paper an optical soliton is a way to mitigate the effect of dispersion in optical fiber, by balance between the Group-velocity Dispersion (GVD) and Self Phase Modulation (SPM).

Comparison between CW Laser source with (33% RZ-DPSK) modulation formats and soliton source system in (1×40 Gb/s) single channel show that the soliton source has the better performance than the CW Laser, where the soliton source has $Q$ factor of (49.73) dB, while the CW Laser has $Q$ factor of (40.73) dB, when the input power is (5.41) dBm.

On other hand the soliton source has BER (-30.136) dB while CW Laser has BER (-19.29) dB at SNR (4.61836) dB.

Comparison between the CW Laser source with (33% RZ-DPSK) modulation formats and soliton source system in (32×40 Gb/s) multi channel show that the soliton source has the better performance than the CW Laser, where the soliton source has $Q$ factor of (15.62), while the CW Laser has $Q$ factor of (14.63), when the input power is (6.02) dBm.

On other hand the soliton source has BER (-5.03) dB, while CW Laser has BER (-4.14) dB at SNR (6.27) dB.

**Index Terms** - Optical soliton solution, Mitigation of linear and nonlinear channel impairment, dispersion-managed Solitons.

**I. INTRODUCTION**

Optical signals will be distorted while propagating through an optical fiber, due to fiber loss, dispersion and nonlinearity [1]. With the introduction of wavelength division multiplexing (WDM) to increase fiber capacity, it became clear that not only dispersion, but fiber nonlinearity as well, could significantly degrade signal quality [2]. The transmission impairments induced by non-ideal physical layer components can be classified into two categories: linear and nonlinear [3]. Linear impairments, in particular chromatic dispersion (CD) and polarization-mode dispersion (PMD) resulting from fiber transmission are now routinely mitigated by digital signal processing (DSP) in coherent receivers [4]. Nonlinear impairments include self phase modulation (SPM), cross phase modulation (XPM) and four-wave mixing (FWM) [5]. The development of telecommunications presents a wide field for applications of recent achievements of nonlinear physics. May be the most impressive is the use of soliton effects in optical fiber [6]. To achieve a lossless soliton, the group velocity dispersion (GVD) parameter is required to be constant along the fiber length. But it is difficult to achieve a constant GVD parameter, so dispersion compensated fiber is used for increasing the efficiency of the soliton fiber link. These kinds of solitons are called dispersion-managed Solitons [7].

In this paper optical soliton used to mitigation channel impairment, where the soliton system performance improves with increasing transmission distance because the effects of nonlinearity (self-phase modulation) appears to be balanced with effects of linearity (group velocity dispersion).

**System design**

Design of single channel and multi-channel (DWDM) system using different types of optical source (CW Laser and Optical Soliton) at the 40 Gb/s bit.

1) For single channel

ii. Using Optical Soliton

Simulation of single channel transmission system that uses soliton source pulse at bit rate 40 Gb/s is illustrate in figure(1).
Figure (1): The simulated of single channel system with soliton source.

ii. Using CW Laser source

Simulation of single channel transmission system that uses CW Laser source at bit rate 40 Gb/s is illustrate in figure(2).

Figure (2): The simulated of single channel system with CW Laser source.
2) For multi-channel

   i. Using Optical Soliton

Simulation of (32 × 40 Gb/s) multi-channel DWDM system at 50GHz channel spacing that uses soliton source pulse is illustrated in figure(3).

(a): Structure of the transmitter

(b): Structure of the receiver

Figure (3): The receiver and transmitter sides of the simulated DWDM system layout by using soliton source.
Table (1): Parameters of the system.

<table>
<thead>
<tr>
<th>Parameter</th>
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<tr>
<td>Number of channels</td>
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<tr>
<td>Frequency spacing</td>
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<tr>
<td>Electrical filter in reciever.</td>
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</table>

ITU-T G.652 Fiber parameters

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DCF parameters

<table>
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<tr>
<td>DGD parameter (ps/√km)</td>
<td>0.1</td>
</tr>
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</table>

ii. Using CW Laser source

Simulation of (32 × 40 Gb/s) multi-channel DWDM system at 50GHz channel spacing that uses CW Laser source is illustrated in figure(4).
(a) Structure of the transmitter  
(b) Structure of the receiver

Figure (4): The receiver and transmitter sides of the simulated DWDM system layout by using CW Laser source.

Table (2): Parameters of the system.

<table>
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<td>Number of channels</td>
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<td>Frequency spacing</td>
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<td>Parameter</td>
<td>Value</td>
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<td>ITU-T G.652 Fiber parameters</td>
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<tr>
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</tbody>
</table>
II. STIMULATION RESULT AND DISCUSSION

The relationship between Q-factor and power input in the single channel system (1 × 40 Gb/s) for CW Laser source with (33%RZ-DPSK) modulation formats and the soliton source are illustrate in figure (5).

Figure (5): Q-Factor versus input power at 40 Gb/s single channel for soliton source system (W=0.15 bit) and CW Laser source.

The performance of BER related with the SNR in the single channel system (1 × 40 Gb/s) for the CW Laser source and soliton source with symmetric dispersion compensation are illustrate in figure (6).

Figure (6): BER versus SNR for 40 Gb/s single channel with soliton source system (W=0.15) bits and CW Laser source.

The simulation results illustrate that the performance of system with soliton source is better than the CW Laser source.

It can note clearly from figure (6) that the soliton system has Q.factor (49.73691) while CW Laser source has Q.factor(40.7364)dB with distance 70 Km, of power input (5.41667) dBm.

From figure (7) shows that the soliton system has BER (-30.136) dB while CW Laser source has BER (-19.29) dB at SNR (4.61836) dB with 70Km distance.

The eye diagrams of CW Laser source with (33%RZ-DPSK) modulation formats and soliton source in (1 × 40 Gb/s) single channel system with symmetric dispersion compensation are illustrated in figure (7).

Figure (7): The eye diagrams at 40 Gb/s single channel for soliton source system (W=0.15) bits and CW Laser source.

The eye diagrams of CW Laser source with (33%RZ-DPSK) modulation formats and soliton source in (1 × 40 Gb/s) single channel system with symmetric dispersion compensation are illustrated in figure (7).

The relationship between Q-factor and power input in (32 × 40 Gb/s) multi-channel DWDM system for CW Laser source with
(33%RZ-DPSK) modulation formats and the soliton source (W=0.15 bit) are illustrate in figure (8).

![Figure (8): Q-Factor versus input power at (32 × 40 Gb/s) multi-channel for soliton source system (W=0.15 bit) and CW Laser source.](image)

The performance of BER related with the SNR in (32 × 40 Gb/s) multi-channel DWDM system for the CW Laser source with (33%RZ-DPSK) modulation formats and soliton source (W=0.15bit) are illustrate in figure (9).

![Figure (9): BER versus SNR for (32 × 40 GB/s) multi-channel for soliton source system (W=0.15 bit) and CW Laser source.](image)

The eye diagrams of CW Laser source with (33%RZ-DPSK) modulation formats and soliton source in (32 × 40 Gb/s) multi-channel DWDM system are illustrated in figure (10).

![Figure (10): The eye diagrams for (32 × 40 Gb/s) multi-channel for soliton source system (W=0.15 bit) and CW Laser source.](image)

It can note clearly from figure (8) that the performance of system with soliton source is better than the CW Laser source, where the soliton system has Q.factor (15.62) while CW Laser source has Q.factor(14.63)dB with distance 70 Km, of power input (6.02) dBm.

From figure (9) shows that the soliton system has BER (-5.03) dB while CW Laser source has BER (-4.14) dB at SNR (6.27) dB with 70Km distance

III. CONCLUSION

In this paper, design of (1 × 40 Gb/s) single channel and (32×40 Gb/s) multi-channel DWDM system using different types of optical source (CW Laser and Optical Soliton). The simulation results illustrate that the performance of system with soliton source is better than the CW Laser source with (33%RZ-DPSK) modulation formats.

The soliton system performance Improves with increasing transmission distance because the effects of nonlinearity (self-phase modulation) appears to be balanced with effects of linearity (group velocity dispersion).
REFERENCES


AUTHORS

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Abstract- Data warehouse (DW) is a group of combined databases planned to support various decision-making purposes. The semantic multi attribute model focused on similarity contained in the data warehouse, in DW is critical for the certain group of users. The semantic access right in viewing the dimensional schema should be properly specified according to the level of privilege. A set of security controls has been established to protect this crucial asset. It holds both highly comprehensive then reduced modern data connecting to numerous groups, topics, or areas. Semantic Similarity Actions is one of the latest know-hows that give tree to various and isolated material foundations attractive the decision-making competences of the group. The Semantic Similarity Measures provides an efficient storing mechanism which can identify the information of interest to the organization. The data repository contains information from multiple sources and presents it in an integrated manner to the end user. In this Semantic Similarity used context the filtration of data is realized previously the data warehouse.

Index Terms- Semantic, Similarity model, educational development, warehouse, metadata

I. INTRODUCTION

Data warehousing structure, a huge amount of unemployment was required to provision various choice support surroundings. In superior worries it was characteristic for shared decision provisions environments to operate separately. Though each disorder served dissimilar users, they frequently compulsory abundant of the indistinguishable deposited data.

Exactly calculating the semantic similarity among words is a significant problematic in the warehouse, information retrieval, and normal language processing. Warehouse requests such as, public extraction, relation detection, and entity disambiguation, necessitate the ability to precisely amount the semantic similarity amongst concepts or entities. In material retrieval, one of the main problems is to retrieve a set of forms that is semantically connected to a given manipulator query.

Confidentiality is to confirm that user’s containter only entree the evidence which they have rights for. In the case of warehouse Meta data replicas, privacy is crucial, since business material is very delicate and can be exposed by performing a simple query. Occasionally, warehouse Meta data models also store evidence regarding private or individual features of those, like documentation data or even spiritual beliefs.

In this case, confidentiality is redefined as privacy. Comparing demonstrating method which we take as our base permits us to perfect complex data warehouse situations and at the same time reflects no severe and comprehensive hierarchies, corrupt dimensions, degenerate facts or many-to-many relations amid facts and a specific measurement with the consistent characteristics. Henceforth, we also try to deliver a wider method for modeling a commercial data warehouse, somewhat than a method aimed at demonstrating trivial data marts. Lastly, we cover some applicable conditions such as role orders and section groups for operators, and not objective the typical safety levels of multilevel refuge.

II. RELATED WORK

Performing such complex analysis requires that the meaning of the warehousing repository data be understood entirely, along with its provenance, heritage and lineage, which is achieved by means of metadata [1]. Metadata is not only “data about data”; it has rather a broader sense and role, as it concentrates the totality of information and knowledge of the actual data existent within an enterprise [2]. Metadata captures general and specific characteristics, offers a context and meaning to the raw data and creates the semantic layer of the organization’s informational system [3].

This semantic layer ensures a proper interpretation and understanding of the organization’s data by all the actors involved in its exploitation and usage. The creativity’s informational schemes contain numerous kinds of metadata [4], from commercial and technical metadata, stationary and dynamic metadata, to expressive, structural and directorial. In order to accomplish its functions, metadata has to be properly managed [5].

It also helps to reduce the determinations of data warehouse management and to recover the withdrawal of evidence from the investigatory situation [6]. Inside the data warehousing situation, the metadata composed from numerous sources is deposited in the metadata fountain, which aims to offer reliable and dependable admission to the data and enables enquiring and glancing processes from the end-user [7].

The initiative data warehouse buildings signifies the most comprehensive and multifaceted architectural type in the data warehousing atmosphere and is the consequence of a complete
enterprise-wide analysis of data necessities [8]. Its key goal is to provide an integrated data foundation, defined by atomic level data maintained in normalized process in the information warehouse, then to allow the structure of several multidimensional opinions of combined data complete from the fundamental data warehouse [9]. Warehouse team needs to comprehend the metadata about the foundationschemes to build the data warehouse expansion. The model suggests that a sheet of metadata has to be about the foundationschemes [10].

III. SEMANTIC SIMILARITY MEASURE FOR EDUCATIONAL GROWTH SYSTEM

A novel Semantic Similarity Measures algorithm (SSMA) described for multi attribute based warehousing for optimal combination page counts and its co-occurrence measures and lexical pattern based warehousing is learned using Educational Growth system. Then characterize the quality set over a universe of properties that a decrypt needs to have with a specific end goal to decode the figure message, and uphold it on the substance. In this way, every client with an alternate arrangement of credits is permitted to decode distinctive bits of information per the security strategy. We formally define a SM as a function:

$$\sigma_k: E_k \times E_k \rightarrow R$$

with $E_k$ the set of elements of type $k \in K$ and $K$, the various types of elements which can be compared regarding their semantics, e.g., $K = \{\text{words, concepts, sentences, texts, web pages, instances annotated by concepts, ...}\}$, and $R = \{[0,1], \mathbb{R}^+, \{a, b, c \ldots\}\}$. This expression can be generalized to take into account the comparison of elements of different types. This could be interesting to evaluate entailment of texts or to compare words and concepts to mention a few. However, in this restrict our study to the comparison of pairs of elements of the same nature. We stress that similarity measure must implicitly or explicitly take advantage of semantic evidences. As an example, as we said in the introduction, measures comparing words through their syntactical similarity cannot be considered to be similarity measure; recall that semantics refers to evidences regarding the meaning or the nature of compared elements.

Figure 3.1 over all architecture diagram

A data warehouse is secondhand for retrieving brainy information from huge files. Presently these databases are dispersed across the world. Dispersed data necessity be recovered from multiple locations in to the data warehouse, so here is an obligation for a secure broadcast and upholding confidentiality. We develop our proposal according to a bottom-up algorithm for searching association rules. Our algorithm consists of an adaptation of the traditional semantic algorithm to multidimensional data. In addition, in order to focus on the discovered associations and validate them, we provide a visual representation based on the graphic semiology principles. Such a representation consists of a graphic encoding of frequent patterns and association rules in the same multidimensional space as the one associated with the mined data cube.

3.1 Semantic based Educational Development system:

Data warehouse technology contains tools for repeatedly and logically changing a large quantity of data in to information applicable to the obligation of an end user. Semantic Information exposed by data warehouse can also recover complex evidence about entities cooperating the individual's right to privacy. Semantic based educational development system are perhaps even more semantic in a data warehouse than by clarification a data warehouse contains data united from manifold sources, and therefore from the viewpoint of a hateful separate trying to reduced info a data warehouse container be one of the utmost rewarding boards in an initiative.
Algorithm:
Input: Meta data Md.
Output: semantic Rule set SR.
Start
Read similarity RS.
For each similarity database RS
Recognize the number of attributes.
Rs = \( \sum \text{Attr} \in SR \)
Recognize number of relative’s similarity
Additional semantic values
RS = \( \int_{i=1}^{size(Md)} \sum \text{semantic} \in SR(i) \)
For each semantic S from RS
Divide number of semantic
\( S = \sum \text{Attr}(RS) == \text{meta data} \)
Calculate number of non-sensitive
Add to rule set RS = \( \sum (R \in Rs) \cup SR \)
End
Stop.

Above algorithm is show similarity based Meta data analysis for all educational development process in ware house. Such measures take into account the frequency distribution of different attribute values in a given data set to define similarity between two categorical attribute values. In this paper, we study a variety of similarity measures proposed in diverse research fields ranging from statistics to ecology as well as many of their variations. Each measure uses the information present in the data uniquely to define similarity.

The distinction between approaches that can and cannot be assimilated to similarity is sometime narrow; there is no clear border distinguishing non-semantics to semantic-augmented approaches, but rather a range of approaches. Some explanations can be found in the difficulty to clearly characterize the notion of Meaning. For instance, someone can say that measures used to evaluate lexical distance between words, such as edit distances, capture semantic evidences regarding the meaning of words. Indeed, the sequence of characters associated to a word derives from its etymology which is sometimes related to its meaning,
Flow char for Semantic based Educational Development system

The personalization process is based on the user knowledge about data aggregation, which is the basis of data organization in multidimensional models. Then, our key idea consists of generating new analysis axes by dynamically creating new dimension hierarchies or extending existing old ones. More precisely, we define new granularity levels inside the data warehouse schema. This provides a real time evolution of dimension hierarchies to cope with personalized analysis needs.

1.2 A similarity measure for attribute model:

The similarity measure for DWs encompasses several creativities to comprise attribute model in the DW enterprise. In the define an example model for DW safety based on metadata, its main goal is to decrease user enquiries to only those statistics which remain to be understood by that user. However, this fixes not permit the requirement of complex limits of confidentiality such as deny-allow admittance to a special user uniting groups and security restraints. To achieve the value of a data warehouse, input data must be transformed into an analysis-ready format. In the case of numerical data, data warehousing systems often provide tools to assist in this process. Unfortunately, standard tools are inadequate for producing a relevant analysis axis when data are complex. In such cases, the data warehousing process should be adapted in response to evolving data and information requirements. In a data warehousing phase is crucial. Data integration is a hard task that involves reconciliation at various levels: data models, data schema, data instances, and semantics.

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Algorithm:
Input: Data warehouse attribute DWA,
Output: semantic model SM
Start
  Read attribute DWA.
  Read input query Q.
  Term set SM = $\int Split(Q, \prime)$
  For each term DW from SM
    Recognize the interactive database name.
    If $\int_{i=1}^{size \text{ (meta \_data } )} SM(i). \text{ semantic model } == SM$ then
      Add to semantic set $SS = \sum SM + Ti$
    End
  If $\int_{i=1}^{size \text{ (meta \_data } )} DWA == SM$ Then
  Add to similarity set $Fs = \sum similarity(DWA) + SM$
  End.
Stop.

The clean is basically recycled to encrypt the collected data which is awaiting from various active data, dispersed data and external data sources and after encryption the correspondence data permits into the data warehouse and the determined data is deposited in data warehouse. Data rules instantiate structure rules, meaning that they define the aggregation link on data themselves. To build a new level, the user defines one structure rule, and various data rules. Data rules define the various instances to be created in the new level and the condition that defines the link with the instances of the lower level. Each data rule corresponds to one instance of the level to be created. To design and build data warehouses, traditional data and goal-driven approaches bear the latent risk of not meeting user requirements. Therefore, user-driven developing approaches seem promising for successful completion of data warehouse projects.
Active semantic documentation further extends the scope of clinical decision support by getting its semantic features from automatic semantic annotation to automatic decision making on the text of the archive by applying logically relevant principles to the segments of the archive. Semantic annotations can likewise be used for semantic reports to give a comprehensibility support to customers. In this paper, the benefits of using ontology and semantic annotations are tested in terms of providing an interpretative layer between the text generated by clinicians and its display to consumers in the context of similarity.

IV. RESULTS AND DISCUSSION

The prearranged method has been appreciated and projected for its competence. The consequence demonstrations that the planned method has formed effective results in all the effects of data warehousing, then the technique recovers the routine of educational scheme. The method can be easily adapted to rank and support the online education and E-learning approaches. Also the method has been focused on supporting various other solutions like business intelligence, Administrative support and many more. Accuracy is not really a reliable metric for the real performance of a classifier when the number of samples in different classes vary greatly (unbalanced target) because it will yield misleading results.

![Graph 1: Comparison of clustering accuracy produced](image)

<table>
<thead>
<tr>
<th>Techniques</th>
<th>Clustering Accuracy%</th>
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<td>MCL</td>
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<td>Rough set Theory</td>
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<tr>
<td>Cloud E-Learning</td>
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<td>MAIIM</td>
<td>96.4</td>
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<tr>
<td>SSMA</td>
<td>98.9</td>
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</table>

Table 1 clustering accuracy in different algorithm

The Graph 1 demonstrates the evaluation of clustering correctness twisted by dissimilar approaches on warehousing the data. It demonstrates clearly that the planned method has twisted a more effective result than other approaches. This recommends denial of any characteristic or any single customer in a quality social event would impact all customers in the get-together. It may achieve clustering of the windows of clustering. That the plan just requires just a single authenticator for each square, it has two serious downsides. To begin with, since the confirmation procedure requires mystery material, there will be security issues while stretching.
Table 2 Educational growth support efficiency

<table>
<thead>
<tr>
<th>Techniques</th>
<th>Educational Support %</th>
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<td>97.8</td>
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<tr>
<td>SSMA</td>
<td>98.8</td>
</tr>
</tbody>
</table>

Graph 2: Evaluation of educational support efficiency

The Graph 2, demonstrates the evaluation of educational support efficiency formed by dissimilar methods and it demonstrates obviously that the planned method has formed more provision than other methods. At least one of these credits will be utilized to approve the personality of the client and hence the approach resolver comprises of various subcomponents to confirm the demand of the client in view of his traits and entitle the gave character related standards and arrangements.

V. CONCLUSION

The method computes the semantic similarity measure based algorithm, and using the measure computed the method validate the user request to maintain integrity. The planned method recovers the routine of the query processing and improves clustering efficiency also. In addition to improving the accuracy, educational support efficiency attains to enhance the future process to produce best results.

REFERENCES


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Evaluation of milk production performance of lactating Fogera cows fed with urea and effective micro-organisms treated rice straw as basal diet

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Abstract- The study was conducted for Nine Fogera cows with average age, parity, initial body weight and stage of lactation was 9.3 year, 4.4, 262.7kg and 53.1 days, respectively used for the feeding trial were randomly assigned to three treatments. The treatments were 67% wheat bran and 33% NSC from 2kg concentrate + untreated rice straw (T1), 67% wheat bran and 33% NSC from 2kg concentrate + urea treated rice straw (T2) and 67% wheat bran and 33% NSC from 2kg concentrate + rice straw treated by effective micro-organism (T3). Animals were blocked based on their initial body weight in randomized complete block design. Feeding of Fogera cows with EMO treated rice straw resulted in significantly (p<0.05) higher daily dry matter intake (8.52 kg/cow, higher daily weight gain (27.7 g/day), higher daily milk yield (2.82l/day) and highest net income and marginal return rate (MRR) (82.6 and 194%, respectively) when compared with those cows fed on untreated rice straw. Hence, according to the results of this study feeding of lactating Fogera cows with EMO treated rice straw is efficient for both biologically and economically compared to urea treated rice straw.

Index Terms- effective microorganism, lactating cows, rice straw, milk yield, urea treatment

I. INTRODUCTION

Livestock in Ethiopia provide draught power; serve as source of income for farming communities, means of investment and important source of foreign exchange earnings. Of the total household cash income of farming community, livestock account for 37 to 87% in different parts of the country (Ayele et al., 2003). The livestock population in Amhara National Regional State (ANRS) is estimated at 10.5 million cattle, 8.2 million sheep and 5.1 million goats. Of the cattle population in the region, about 25, 744 are believed to have indigenous and exotic blood (Eshete, 2007), which is only 0.25% of the population is exotic blood and the remaining vast cattle population of the country (99.75%) belongs to indigenous/local breed.

The Fogera cattle found in Fogera Woreda, South Gonder Zone, is used for milk, meat and draft power by smallholder farmers. They are known to have better performance in terms of milk yield, growth rate and tolerance to heat, parasitic burden and adaptability to marshy areas (Gebeyehu, et al., 2004). However, the population and productivity of Fogera cattle breed is declining due to shifting of grazing land in to rice cultivation, damage of grazing land by flood and lack of adequate feeds (Firew and Getnet, 2010).

In Fogera Woreda, rice straw is the most abundant livestock feed resource. But this straw has high fiber content and low digestibility and protein content (3.35%) (Tesfome Derso, 2009). The treated low quality roughages have higher digestibility and crude protein than untreated roughages. According to AlemuYami (2008), farmers feed their high nutrient requiring animals, such as lactating or fattening animals treated low quality roughage by using different mechanism. Therefore, rice straw can be improved by; using different treatment methods like urea and effective micro-organisms. The protein content of feed treated by mixing of different treatment; the mixture of EM contained treatment had highest protein content as compared to the others (Nassia.B. et al., 2013). All the available evidences tend to indicate that EMO could safely and economically be included into animal feed. There is no environmental and public health hazard reported from the use of EM technology in animal feeding. There are experiments done on dairy cows using urea treated rice straw but no work is yet done using effective micro-organism. Hence this study was conducted with the objectives of evaluating the milk production performance and feed intake of Fogera cows provided with rice straw treated by urea and EMO and to compare the nutritive value and the economic benefits of urea and EMO treated rice straw.

II. MATERIAL AND METHODS

The study was conducted at Andassa Livestock Research Center which is located 11°.4 N and 37°.3 E and is located 19km from BahirDar. The minimum and maximum temperature was 22° and 30°, respectively with annual rainfall of 1300 mm. Before commencement of the experiment, all animals were dewormed for internal parasites and nine lactating cows with parity 4 and 5 and two weeks after calving were selected. The experimental cows were assigned to each treatment based on their initial body weight randomly and experimental cows were assigned to each treatment based on different treatment methods like urea and effective micro-organisms. The protein content of feed prepared for 37 to 87% in different parts of the country (Ayele et al., 2003). The livestock population in Amhara National Regional State (ANRS) is estimated at 10.5 million cattle, 8.2 million sheep and 5.1 million goats. Of the cattle population in the region, about 25, 744 are believed to have indigenous and exotic blood (Eshete, 2007), which is only 0.25% of the population is exotic blood and the remaining vast cattle population of the country (99.75%) belongs to indigenous/local breed.

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Experimental feed preparation

The urea treated rice straw was ensiled in polythene sheet with a capacity of 50-100 kg of urea treated rice straw. The ratio of water: urea: straw used was 100:5:100 kg as per the
recommendation of Chenost (1995). The solution of urea and water was uniformly sprayed and mixed to properly incorporate the solution into the straw on batch bases with 100 kg of straw and water each with 5 kg of fertilizer grade urea. The duration of rice straw treatment was for 21 days. After 21 days, urea treated rice straw was provided for the cows based on their requirements (Misra et al., 2006).

For the preparation of effective micro-organism treatment, adequate quantities of an inert form of EM (EM-1) packed in plastic bottles was obtain from Bahir Dar its branch of Welijjie PLC (Debrezeit). The procedure was chopped the rice straw within the 2-3cm length, prepared 1litter of inactive EM and molasses and 18 litter of water. Then the molasses, EM1 and water were thoroughly mixed to activate the microorganism. After stirring, the mixture (one liter of EMO) was inoculated into or sprayed over (50-70 kg) of rice straw. The mixed solution was finally incubate in an airtight container for microbial fermentation and multiplication and stored for 10 days in dark room with room temperature (Higa and Wидидана, 2007).

Experimental design and treatments

The experiment was conducted by a randomized complete block design (RCBD) involving three treatments. The three treatment combinations were the following:

T1: concentrate+ untreated rice straw
T2: concentrate+ rice straw treated by urea
T3: concentrate + rice straw treated by EMO

Data Collection

Chemical composition of feeds

All samples of feed offered and refusals were analyzed for DM, N (Kjeldahl-N) and ash content according to AOAC (1990) procedures in Bahir Dar University, Engineering Faculty, and school of Food Technology. Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined by the methods of Van Soest et al., (1991) in laboratory of international livestock research institute (ILRI) in Addis Ababa.

Milk yield and composition analysis

Half of the experimental cow’s teat were hand milked twice a day (at 8:00 am in the morning and 4:00 pm in the evening), the left teat for the first fifteen days and right teat for the next fifteen days and the average daily milk yield per cow was calculated by multiplying the daily milk yield from half of the teat by two and milk yield measurements were taken by using graduated cylinder every day throughout the study period. The average daily milk yield of the individual lactating cow was determined dividing the total milk yield of experimental cow by the number of experimental days. Every fifteen days interval, 100 ml of milk samples were taken using a glass measuring cylinder for each cow after the completion of the adaptation period for chemical analysis. The milk samples were used to determine percentage of fat, protein and ash. Fat content of the milk was estimated using the Gerber analytical method and the formaldehyde titration method was used to determine the total protein content of milk (Van Soest et al., 1991).

Animal’s body weight

The body weights (BW) of animals were measured by using heart girth at fifteen days intervals throughout the experiment to determine BW change. Body weights were recorded for each lactating cow against its identification number on a weight registration notebook. The body weights of lactating cows were taken within fifteen days interval by overnight fasting. Body weight changes were determined as a difference between the final and initial body weight, where both measurements were taken as a sum of two consecutive weightings. The daily body weight gains (DBWG) were calculated as the difference between final BW and initial BW divided by number experimental days. The feed conversion efficiency of experimental animals was determined as the ratio of daily body weight gain to the amount of feed consumed for the total experimental days.

Feed intake

A weighed amount of feed was offered twice per day at 8:00 am in the morning and 4:00 pm in the afternoon. Orts were collected for the next morning and weighed after removing external contaminants by visual inspection. For each replicate, the feed offered and refusal were recorded. The amount of feed consumed was determined as the difference between the feed offered and refused on dry matter (DM) basis.

Partial budget analysis

The partial budget analysis was performed to evaluate the economic advantage of the different treatments by using the procedure of Upton (1979). The analysis involved the calculation of the variable costs of experimental milk, feeds and benefits gained from the result. At the end of the experiment, experienced milk dealers from Bahir Dar market estimated the selling price of experimental lactating Fogera cow’s milk. In the analysis, the total return (TR) was determined by calculating the difference between selling and purchasing price of lactating Fogera cow’s milk in each treatment at the beginning and the end of the experiment. The cost of feeds was computed by multiplying the actual feed intake for the whole feeding period with the prevailing prices.

III. RESULTS AND DISCUSSION

Chemical composition of experimental feeds

The chemical composition of different experimental feeds is shown in Table 1. The dry matter of rice straw treated by urea in this experiment was contradictory to the DM content of 95.5% and 69.1% reported by Teshome (2009) and Promma et al. (1993), respectively. But similar with Hany (2000) reported 91.5% DM content of rice straw. The CP content of rice straw in this experiment disagrees with the CP content of 7.6 reported by Promma (1993); this disagreement is may be due the stage of rice harvested and the time and season differences. But agree with the CP content of 3.35% and 3.5% reported by Teshome (2009) and (Yuangklang et al., 2009), respectively. The CP content of rice straw used in the current experiment is greater than the CP content of 2.76% and 4.99% that reported by Parnich (1983) for untreated and urea treated rice straw, respectively. But the ADF of rice straw used in the current experiment was less than that
reported by Parnich (1983) but the ADL was greater in the current finding. The fiber content of rice straw treated by effective micro-organisms was low as compared to untreated rice straw.

Table 1. Chemical composition of rice straw treated by EMO, urea and untreated

<table>
<thead>
<tr>
<th>Chemicals composition of Offered feed</th>
<th>Treatment diet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>DM (%)</td>
<td>91.9</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>18.2</td>
</tr>
<tr>
<td>CP (% DM)</td>
<td>3.46</td>
</tr>
<tr>
<td>CF (% DM)</td>
<td>32.1</td>
</tr>
<tr>
<td>NDF (% DM)</td>
<td>69.1</td>
</tr>
<tr>
<td>ADF (% DM)</td>
<td>43.7</td>
</tr>
<tr>
<td>ADL (% DM)</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Dry matter intake

Dry matter intake (DMI) of lactating Fogera cows fed diet containing rice straw treated by effective micro-organism and urea is presented in Table 2. The daily dry matter intake of lactating cows fed rice straw treated by EMO was significantly (P<0.05) higher than untreated rice straw. The intake of rice straw in the current experiments agrees with the report of Wanapat et al, (2013). In the current experiment, the daily dry matter intake of urea treated and untreated rice straw was significantly greater than 5.65 kg and 4.91kg per day, respectively that reported by Parnich (1983). But daily dry matter intake of urea treated rice straw reported by Wanapat (2013) was in line with the findings of this experiment.

Feed intake is a very important factor that determines the production of milk and body weight, in cows (McAinsh and Riise, 2005). The result of the present study indicates that the feed intake as well as milk production of lactating Fogera cows increased when the rice straw was treated by urea and effective micro-organism as compared to untreated rice straw.

Table 2. Feed intake and milk yield of Fogera cows fed untreated rice straw and treated by EMO and urea

<table>
<thead>
<tr>
<th>Body weight</th>
<th>Treatment</th>
<th>SEM</th>
<th>SL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDMC (kg/cow)</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>13.4</td>
<td>Ns</td>
</tr>
<tr>
<td>DDMI (kg/cow/day)</td>
<td>6.34b</td>
<td>7.98ab</td>
<td>8.52a</td>
</tr>
<tr>
<td></td>
<td>0.15</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>MY (L/Cow/day)</td>
<td>2.34b</td>
<td>2.4ab</td>
<td>2.82a</td>
</tr>
<tr>
<td></td>
<td>0.007</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Milk production and composition

As we observed from the table 3 milk composition of lactating cow for feeding of urea treated rice straw had good protein content as compared to the remaining treatments. As we absorbed from the table the protein content of milk when an animal’s fed urea treated rice straw was also high as compared to other treatments. This is the reason urea has nitrogen rich compound which contribute protein for milk and feed. The nitrogen content of lactating cow’s milk for the current experiment was higher than 3.2% and 3.3% animals that fed untreated and urea treated rice straw, respectively reported by Wanapat (2013) and Thaintip (2013). The fat content of the current experiment was similar with the study of Hart (1992). However, the fat and protein content of milk which animal’s fed urea treated and untreated rice straw was lower than that reported by Wanapat et al. (2013) and Hart (1992), on Holstein crossbred dairy cattle in Thailand and Buffalo in Australia, respectively.

Table 3. Chemical composition of milk used for different experimental treatments

<table>
<thead>
<tr>
<th>Chemical composition</th>
<th>Milk</th>
<th>T 1</th>
<th>T 2</th>
<th>T 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM (%)</td>
<td></td>
<td>13.12</td>
<td>15.61</td>
<td>13.56</td>
</tr>
<tr>
<td>CP (% DM)</td>
<td>3.42</td>
<td>3.77</td>
<td>3.48</td>
<td></td>
</tr>
<tr>
<td>CF (% DM)</td>
<td>3.50</td>
<td>3.63</td>
<td>3.33</td>
<td></td>
</tr>
<tr>
<td>Ash (% DM)</td>
<td>0.70</td>
<td>0.73</td>
<td>0.75</td>
<td></td>
</tr>
</tbody>
</table>

Milk composition and production are the interaction of many elements within the cow and external environments (O’Connor, 1994). High milk yield of satisfactory composition is the most important factor ensuring high economic returns. If the composition of milk varies widely, its implication is that feed value and its availability as a raw material will also vary. Feeding of urea treated rice straw

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alone had given an extra milk yield of 1.16 kg in lactating animal per day in the study area. which is similar to 1-1.5 kg milk per day reported by Khan and Davis (1981) and Pedock et al. (1982). Similar results were also reported by Mesfin et al. (2009), and Getu (2006) indicating that cows fed urea treated teff straw and wheat straw respectively had significantly higher milk yield than non-supplemented crossbred cows.

In the current experiment there was significant difference (P<0.05) between the cows fed on treated and untreated rice straw taking groups of cows in milk yield. The effect of inclusion of effective micro-organism treated rice straw in lactating Fogera cow’s daily milk yield is depicted in Table 2 and Figure 1. Milk yield of lactating Fogera cows that fed rice straw treated by effective micro-organism was significantly (P<0.05) higher than untreated rice straw. Milk production in all treatments of the current experiment is similar with Teshome (2009). Different experiments showed that cows fed urea treated rice straw produced higher daily milk yields compared to cows fed untreated rice straw (Wanapat, 2013). The milk production depends on the intake of feed. Therefore, this experiment also indicated that the milk yield increased with the increment in dry matter intake of Fogera cattle.

Body weight change

The effect of inclusion of rice straw treated effective micro-organism on body weight change of Fogera cows is represented in Table 4. According to Mukassa-Mugerwa (1989), lactating cows will probably lose weight after calving, but weight loss should be minimized through good feeding to allow them to start cycling again and to allow annual calving. During the early lactation (first three months after calving) all cows in the current study lost body weight, with a declining trend with advance in lactation. Requirements for the observed daily mean milk yield (2.31 kg/day) from this trial were not met at all levels of supplementation; but the estimated MEI requirement (63MJ/day) for maintenance and milk production of lactating dairy cow weighing 250 kg (average body weight of the experimental animals) and producing 4.6kg/day milk of 4.5% butter fat (ARC, 1990). The finding from this trial clearly supports this idea suggested by Preston and Leng (1986) that molasses or alkali treated straw based diets are more digestible, but they support little improvement in animal productivity unless they are supplemented with bypass nutrients. There was no significance difference in initial body weight and final body weight among treatments, but mean daily body weight gain of cows fed diet consisting rice straw treated by EMO was significantly (P<0.05) higher than T1. The result indicated that the daily body weight gain and feed conversion efficiency was increased when lactating cows were fed rice straw treated by urea and effective micro-organism accordingly. The findings of this experiment contradicts with the findings of Teshome (2009), who reported reduced growth rate of lactating cows when fed with untreated rice straw unlike urea treated rice straw. This discrepancy could be due to the supplementation of 2 kg concentrate feed in this experiment for lactating cows which were fed on untreated rice straw. The other reason in this experiment could be the short experimental period; 30 days is not enough to evaluate the change in weight of the experimental animals.

<table>
<thead>
<tr>
<th>Body weight</th>
<th>Treatment</th>
<th>SEM</th>
<th>SL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td>Initial body weight (kg)</td>
<td>262.0</td>
<td>245.33</td>
<td>254.67</td>
</tr>
<tr>
<td>Final body weight (kg)</td>
<td>262.4</td>
<td>245.95</td>
<td>255.5</td>
</tr>
<tr>
<td>MDBWG (g)</td>
<td>13.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>20.7&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>27.7&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>FCE</td>
<td>0.069</td>
<td>0.086</td>
<td>0.108</td>
</tr>
</tbody>
</table>

Figure 1. Feed intake and milk yield of lactating Fogera cows fed untreated rice straw and treated by EMO and urea.
**Partial budget analysis**

The partial budget analysis for the feeding trial is presented in Table 5. The result of the partial budget analysis indicated that the gross financial margin or total return obtained in this trial was 411, 419, and 493 ETB/cow for lactating Fogera cows fed on T1, T2 and T3 diets, respectively. As it is indicated from the partial budget analysis in Table 5, lactating Fogera cows fed on effective micro-organism treated rice straw(T3) returned a higher net income (234.33 ETB/cow) as compared to the other treatments.

The net return from each treatment was 194.25, 132.79 and 234.33 ETB/head for T1, T2 and T3, respectively. The percent of marginal rate of return (MRR) was 11 and 194 for T2 and T3, respectively. Thus, it indicated that each additional unit of one ETB per liter of milk cost increment resulted in one ETB and additional 0.11 and 1.94 ETB benefit for T2 and T3, respectively. Lactating Fogera cows fed on rice straw treated by effective micro-organism (T3) had the highest net income and MRR value (82.6 and 194%, respectively) as compared to the other treatment groups. Therefore, feeding of rice straw for lactating cows treated by urea and effective micro-organism had better economic benefits as compared to feeding of untreated rice straw.

**Table 5. Partial budget analysis for lactating Fogera cows fed urea treated rice straw and EMO**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatments</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchasing price of milk</td>
<td></td>
<td>11.16</td>
<td>11.16</td>
<td>11.16</td>
</tr>
<tr>
<td>ETB/cow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed consumed (kg/cow)</td>
<td></td>
<td>255.47</td>
<td>224.53</td>
<td>251.50</td>
</tr>
<tr>
<td>Rice straw consumed (kg/cow)</td>
<td></td>
<td>255.47</td>
<td>220.13</td>
<td>239.33</td>
</tr>
<tr>
<td>Total supplement consumed</td>
<td>-</td>
<td>4.4</td>
<td>11.97</td>
<td></td>
</tr>
<tr>
<td>(kg/cow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor cost ETB</td>
<td></td>
<td>25.5</td>
<td>27.70</td>
<td>31.48</td>
</tr>
<tr>
<td>Total feed cost (ETB/cow)</td>
<td></td>
<td>216.99</td>
<td>286.37</td>
<td>259.51</td>
</tr>
<tr>
<td>(TVC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of rice (ETB/cow)</td>
<td></td>
<td>216.99</td>
<td>186.77</td>
<td>189.88</td>
</tr>
<tr>
<td>Cost of supplements (ETB/cow)</td>
<td></td>
<td>-</td>
<td>99.10</td>
<td>69.63</td>
</tr>
<tr>
<td>Gross income (R) (ETB/cow)</td>
<td></td>
<td>422.4</td>
<td>432.6</td>
<td>508.44</td>
</tr>
<tr>
<td>Total return (TR) (ETB/cow)</td>
<td></td>
<td>411.24</td>
<td>419.16</td>
<td>493.84</td>
</tr>
<tr>
<td>Net return (NR) (ETB/cow)</td>
<td></td>
<td>194.25</td>
<td>132.79</td>
<td>234.93</td>
</tr>
<tr>
<td>Change of net income (ANI)</td>
<td></td>
<td>-</td>
<td>7.92</td>
<td>82.6</td>
</tr>
<tr>
<td>Change of total variable</td>
<td></td>
<td>-</td>
<td>69.38</td>
<td>42.52</td>
</tr>
<tr>
<td>cost (ΔTVC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRR (ANI/(ΔTVC))</td>
<td>-</td>
<td>0.11</td>
<td>1.94</td>
<td></td>
</tr>
</tbody>
</table>

**IV. CONCLUSIONS**

Lactating Fogera cows fed rice straw treated by effective micro-organism (T3) had the highest net income and MRR value as compared to the other treatment groups. Therefore, feeding of rice straw for lactating cows treated by effective micro-organism had better economic benefits as compared to feeding of untreated and urea treated rice straw. Hence, we recommended that, rice straw treated by effective micro-organism is higher than urea treatment in many aspects, like its effect on milk production, feed intake, and the aroma of the treated straw is also acceptable by the animals. In addition to this it is also economically profitable and hence we recommend effective micro-organism treated rice straw as an efficient way of treating rice straw. However, further on farm trial has to be conducted to verify the on-station findings of this experiment.

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**REFERENCES**


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Optical characterization of the CdZnSe$_{2x}$Te$_{2(1-x)}$ thin films deposited by spray pyrolysis method

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Abstract- CdZnSe$_{2x}$Te$_{2(1-x)}$ thin films for different composition parameters x have been deposited on large substrate area by the spray pyrolysis method which is simple, inexpensive and economical at 300° substrate temperature. From the optical transmission and reflection spectra, absorption coefficients were calculated . Band gap energy were determined from absorbance measurements in visible range using Tauc theory. Band gap energy values are found to lie in the range 2.04-2.52 eV for the films with composition parameter, x = 0 to 1. It shows that the main transition at the fundamental absorption edge is a direct allowed transition. The optical constants such as optical band gap, extinction coefficient, refractive index and dielectric constant have been calculated for these films. The values obtained by this method are suitable for many scientific studies and technical applications such as solar cells, heat mirrors, transparent electrodes, piezoelectric devices, sensors etc.

Index Terms- thin films,spray pyrolysis,optical constants, band gap energy.

I. INTRODUCTION

The II-VI compounds such as CdTe, CdSe,ZnSe,ZnTe,CdZnSe,CdZnTe etc.are becoming more interesting and important because of their major contribution in solar cells[1] and various optoelectronic devices [2-5],field effect transistors[6],light emitting diodes [7-8] photocalyst[9]. Cadmium zink selenide,one of the II-VI group semiconductor material,plays a prominent role in the modern material science and technology. CdZnSe and CdZnTe are n-type semiconductor materials having wide band gap covering maximum electromagnetic spectrum[10].

There are many methods of depositing II-VI alloy compounds such as thermal evaporation [11], vapour phase deposition of high quality II-VI alloy crystals[12],spray pyrolysis [13-20],electrodeposition[21],chemical bath deposition[22]. Spray pyrolysis technique is most simple and economical method. The advantage of the technique is that just by varying the concentration of precursors and substrate temperature, it is possible to control stoichiometry of the deposits. Hence the thin films of CdZnSe$_{2x}$Te$_{2(1-x)}$ have been prepared by spray pyrolysis technique.

We can determine direct or indirect band gap from optical absorption spectra. Absorption coefficient ‘α’ can be determine from relation

\[ α = (1/t) \ln(I/T), \]

\[ α = \frac{1}{t} \ln(1/T), \]

where t- thickness of thin film and T- transmittance.

The evaluation of refractive index of optical material is of importance for applications in integrated optical devices such as modulators, filters where refractive index of material plays vital role in fabrication of these devices.

Aim of the study is to investigate optical properties of CdZnSe$_{2x}$Te$_{2(1-x)}$ thin films to calculate optical constants such as optical band gap, extinction coefficient, refractive index and real and imaginary parts of dielectric constant.

II. EXPERIMENTAL

2.1 Materials:-

The deposition was carried out onto commercial available glass substrate. The chemicals used were of analytical reagent grade. Aqueous solutions (0.02M) of ZnCl$_2$, CdCl$_2$, TeCl$_4$ and SeO$_2$ were used for spraying the films. Composition parameter ‘x’ in CdZnSe$_{2x}$Te$_{2(1-x)}$ was varied as x= 0 , .25 ,.50 ,.75, 1 in steps and films were deposited on glass substrate. Temperature of substrate was maintain at 300°C and was measured by precalibrated upper constantan thermocouple. Spray rate was maintained at 3.5 ml/min. and spraying was done in air at 12 Kg/Cm$^2$ pressure. The sprayer was mechanically moved to and fro to avoid formation of droplets on the substrate and to ensure the instant evaporation from the substrate. The films were allowed to cool at room temperature. The thickness of the films were calculated by weighing the glass substrate before and after deposition on unipan- microbalance. The density of mixed crystal film material formed on the glass substrate was calculated by adding the standard densities of CdZnSe and CdZnTe in proportion to x and 1-x. The thickness of film so obtained was of the order of 0.1730 μm. The colour of the film changes from whitis to grey as composition parameter changes from 0 to 1.

2.2 Optical measurements:-

The optical absorption spectra of CdZnSe$_{2x}$Te$_{2(1-x)}$ thin films at room temperature were obtained on shimadzu uv-1800 series spectrophotometer in the wavelength range 350 – 1100 nm. For the calculation of absorption coefficient (α) at various wavelengths the method used by Rubin et.al.[23] was adopted. For the sample of thickness ‘t’, α is given by the relation,

\[ α = \frac{1}{t} \ln(I_0/I), \]

where $I_0$ and I are the intensities of incident and transmitted radiations respectively.

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Absorption coefficient is also related to % transmittance by
\[ \alpha = \left( \frac{1}{t} \right) \ln(1/T) \]  \hspace{1cm} (3).

To find absorption coefficient the graph was plotted between % transmittance and wavelength as shown in fig.1.F graph value of absorption coefficient ( \( \alpha \) ) at each wavelength was calculated using above relation.

Optical band gap can be determined from the graph between \((\alpha h_{\nu})^2\) and \((h_{\nu})\) and extrapolating the graph on \((h_{\nu})\) axis. The extinction coefficient \( k \) is related to absorption coefficient \( \alpha \) by the relation,
\[ K = \frac{\alpha \lambda}{4 \pi}. \]  \hspace{1cm} (4)

Refractive index \( n \) for the film is calculated using the relation,
\[ n = \left( \frac{1 + R}{1-R} \right) + \left[ \frac{4R}{(1+R)^2-k^2} \right]^{1/2}. \]  \hspace{1cm} (5)
Where \( R \) is the reflection.

The real and imaginary parts of dielectric constant are given by the relations [19],
\[ \varepsilon_1 = n^2-k^2 \]  \hspace{1cm} (6)
\[ \varepsilon_2 = 2nk \]  \hspace{1cm} (7)

III. RESULTS AND DISCUSSION

The transmission spectra of of CdZnSe\(_{2x}\)Te\(_{2(1-x)}\) for composition parameter \( x = 0, .25, .50, .75, 1 \) thin films of thickness 0.1730 \( \mu \)m are shown in fig.1.

Average transmission values are 75.5%, 80%, 82%, 92% in the wavelength range 350-1100 nm. It is found that % transmittance depends upon composition parameter \( x \). As \( x \) increases, %T also goes on increasing and it is found that CdZnSe\(_2\) thin films have higher values of %T.

To calculate the optical band gap the graphs are plotted between \((\alpha h_{\nu})^2\) vs. photon energy\((h_{\nu})\) of the thin films of CdZnSe\(_{2x}\)Te\(_{2(1-x)}\) of different composition parameters \( x = 0, .25, .50, .75, 1 \) as shown in fig. 2.
From the nature of graphs it is seen that each graph is linear above its absorption band edge. This linear relation indicates the direct allowed transition described by relation [24],

$$\alpha = \frac{\text{-A/hv}}{(\text{hv-E}_g)^{1/2}} \quad (9)$$

where \( n=2 \) for direct allowed transition.

The optical band gap energies \( E_g \) for thin films of different composition parameters can be determined from intercepts on hv axis.

**The band gap values are as shown in table below.**

<table>
<thead>
<tr>
<th>Composition parameter(x)</th>
<th>Material ( \text{CdZnSe}<em>{2x}\text{Te}</em>{2(1-x)} )</th>
<th>( E_g ) (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>( \text{CdZnTe}_2 )</td>
<td>2.04</td>
</tr>
<tr>
<td>.25</td>
<td>( \text{CdZnSe}<em>{1.5}\text{Te}</em>{1.5} )</td>
<td>2.27</td>
</tr>
</tbody>
</table>

These values are found to be in good agreement with that obtained by Zunger at.\text{el.} and Nesheva at.\text{el.}[25-26]. It is also found that as composition \( x \) increases i.e. Se content increases, optical band gap energy value also goes on increasing. The extinction coefficient \( (k) \) and refractive index\( (n) \) are also calculated for \( \text{CdZnSe}_{2x}\text{Te}_{2(1-x)} \) thin films of different composition parameters \((x=0 \text{ to } 1)\). The graph is plotted between extinction coefficient and wavelength as shown in fig. 3. From graph it is seen that extinction coefficient decreases with increasing wavelength.

![Fig. 3. Variation of extinction coefficient (k) of \( \text{CdZnSe}_{2x}\text{Te}_{2(1-x)} \) thin films with wavelength for composition parameter \( a)x=0, b)x=.25, c)x=.5, d)x=1 \) ](image)

The graph is also plotted between refractive index and wavelength as shown in fig. 4. Graph shows that refractive index decreases with increasing wavelength. It is also found that both extinction coefficient and refractive index decreases as 'Se content goes on increasing.
Fig. 4. Variation of refractive index (n) of CdZnSe\(_{2x}\)Te\(_{(2-1x)}\) thin films with wavelength for composition parameter a)\(x=0\), b)\(x=.25\), c)\(x=.5\), d)\(x=1\).

We also calculated real and imaginary parts of dielectric constant. The variation of real (\(\varepsilon_1\)) and imaginary (\(\varepsilon_2\)) parts of dielectric constant with wavelength are shown in Figs. 5 and 6 respectively. Both \(\varepsilon_1\) and \(\varepsilon_2\) decreases with wavelength. It is found that values of real part are higher than those of imaginary parts. Thus increasing selenium content causes important changes in optical constants.

![Graph showing variation of real part of dielectric constant with wavelength](image1)

![Graph showing variation of imaginary part of dielectric constant with wavelength](image2)

IV. CONCLUSIONS

CdZnSe\(_{2x}\)Te\(_{(2-1x)}\) thin films of composition parameter \(x=0, .25, .50, .75, 1\) have been deposited on glass substrate by spray pyrolysis method at substrate temperature 300°C. The average transmission values are found to vary from 75.5% to 92% for \(x=0, .25, .50, .75\) and 1. The optical constants such as optical band gap, absorption coefficient, extinction coefficient, refractive index, real and imaginary parts of dielectric constant were calculated. The optical band gap increases with Selenium content. The optical band gap vary from 2.04eV to 2.52eV for thin films with composition parameter \(x=0\) to 1. Absorption spectra shows that absorption is due to direct transition. The extinction coefficient, refractive index, real and imaginary parts of dielectric constant for thin films decreases with wavelength. Thus the influence of selenium content on optical properties of CdZnSe\(_{2x}\)Te\(_{(2-1x)}\) thin films is noticeable.
REFERENCES


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Experimental Study on Helical Coil Heat Exchanger

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Abstract - The recovery of waste heat has been a topic of concern for large-scale industrial companies for several decades. This recovery not only makes an operation more environment friendly, but it also helps to cut costs. In addition to this, it can reduce the amount of resources needed to power a facility. Many industries have implemented different methods of waste heat recovery. One popular choice is using a heat exchanger. This paper presents the study of two types of heat exchangers: straight and helical coil tube. The helical coil heat exchanger has been experimented and analyzed on the basic of log-mean temperature difference (LMTD), heat transfer coefficient and Reynolds number. Based on the results, it is found that helical coil heat exchangers are efficient and its overall heat transfer coefficient increases with mass flow rate.

Index Terms - helical coil heat exchanger, fouling, heat transfer coefficient, LMTD and Reynolds number

I. INTRODUCTION

The heat is a form of energy that transfers from the hot object to the cold object, and it transferred through the conduction, the convection and the radiation. The heat energy has many usages in the industry as making metals, chemicals, refining oil and processing the food. The shortage of heat energy leads to conserve or to make best use of it. In several industrial processes there is waste of energy or a heat stream that being exhausted in atmosphere. The heat exchangers plays important role to recover this heat and place it to use by heating a different stream within the process. This practice saves a lot of money in industry, as the heat supplied to other streams from the heat exchangers would otherwise come from an external source that is more expensive and more harmful to the environment. The purpose of constructing a heat exchanger is to get an efficient technique of heat transfer from one fluid to another, by direct contact or by indirect contact. In a heat exchanger the heat transfer through radiation is negligible in comparison to conduction and convection. But convection plays the major role in the performance of a heat exchanger. There are numerous applications of heat exchangers such as heat recovery systems, refrigeration, waste water treatment plants, pharmaceuticals, oil and gas industries, HVAC, food & beverage processing industries. In addition to these applications heat exchangers are also used in large scale chemical and process industries for transferring the heat between two fluids which are at a single or two states [1].

In general, the heat transfer techniques can be divided into two groups: active and passive. The active techniques need external forces like fluid vibration, electric field and surface vibration where as passive techniques requires special surface geometries like varied tube inserts. The straight tube heat exchanger has been the oldest type of heat exchanger that has been in use.

The research work has been performed by various investigators on enhancing the performance of straight tube heat exchanger by changing geometric such as baffle arrangement [2], types of tube arrangement, length of the pipe etc. The main challenge in heat exchanger design is to make it compact and to get maximum heat transfer in minimum space. However, it was found that straight tube heat exchangers have restriction in terms of sizing and space which are significant parameters while designing industrial heat exchangers. In 1970 Charles Boardman and John Germer introduced helical coil tube heat exchanger as one of the best passive heat transfer enhancement techniques. The various experimental research work have indicated that helical coil tube heat exchangers are the most useful because of its spiral coil configuration which provides more heat transfer area and better flow in minimum space [3]. This configuration leads higher heat transfer coefficient as compared to straight tube heat exchanger under the same experimental conditions.

II. STRAIGHT TUBE HEAT EXCHANGERS

Straight tube is the type of shell and tube heat exchangers and this is one of the most popular types of heat exchanger due to its flexibility and can be used in systems with higher operating temperatures and pressures. The shell and tube heat exchanger consists of front header, rear header, tube bundle and shell. The fluid enters the tube side of the exchanger via front header and leaves the exchanger through rear header. The tube bundle comprises of the straight tubes, tube sheets, baffles and tie rods etc. to hold the bundle together. The bundle of parallel heat exchanger tubes held in place with tube sheets and placed into a shell. Figure 1 illustrate the straight tube heat exchanger where two fluids will exchange heat, one fluid flows over the surface of the tubes whereas the second fluid flows through the tubes. The fluids can be single or two phase and can flow in a parallel or a cross/counter flow arrangement. However experimental studies proven that the straight tube heat exchangers have many disadvantages such as less heat transfer efficiency and require more space [4]. The cleaning of straight tubes is difficult and fouling is often a problem when overall heat transfer coefficient is addressed. This needs periodic cleaning of the shell as well as the tubes.

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III. HELICAL COIL HEAT EXCHANGERS

The helical coil heat exchangers are a compact shell and tube design consisting of several layers of coiled tubes within a closed shell. The basic construction of the type used for this experimental work with the appropriate nomenclature is illustrated in Figure 1. The helical coil has:

- \( H \) – Height of pitch,
- \( 2r \) – Diameter of tube,
- \( 2Rc \) – Diameter of helical coil,
- \( i \) – Curvature ratio (i.e. ratio of tube and coil diameter),
- \( 2\alpha \) – The helix angle (angle between its projection on a surface and measuring angle between the coils).

The flowing fluid experiences centrifugal force because of curved shape of the tube. The local axial velocity of the fluid particle and the radius of curvature of the coil decide the magnitude of centrifugal force experienced. The velocity of fluid particles flowing at the core of the tube is higher than those flowing near to the tube wall. Thus, less centrifugal force will be experienced by the fluid particles flowing close to the tube wall than in the tube core. This pushes the fluid from the core region towards the outer wall (away from the coil axis). This stream bifurcates at the wall and drives the fluid towards the inner wall on the tube bound, inflicting generation of counter-rotating vortices referred to as secondary flows [5]. This leads to produce extra transport of the fluid over the cross section of the tube. This extra convective transport will increase the heat transfer and therefore the pressure drop when compared to straight tube. It’s been found that the impact of coil curvature is to suppress turbulent fluctuations arising within the flowing fluid and smoothing the emergence of turbulence. Thus it will increase the value of the Reynolds number (Re) needed to attain a fully turbulent flow, as compared to it of a straight pipe. The impact of turbulent fluctuations suppression enhances as the curvature ratio of coil increases.

- **Fouling in Heat Exchangers**

The deposition of any unwanted material on heat transfer surfaces is named as fouling. This could considerably impact on the thermal and mechanical performance of heat exchangers. Fouling could be a dynamic development that changes with time and that will increase thermal resistance and lowers the heat transfer coefficient of heat exchangers. In addition to this, it also impedes fluid flow, accelerates corrosion and will increase pressure drop across heat exchangers. Helical coil heat exchangers have shown significance enhancements in fouling behavior of heat exchangers operation [6]. The quadrant shaped shells side baffles plates are arranged at an angle to the tube axis creating helical flow pattern on the shell sides. Because of this flow pattern, it provides low fouling characteristics which increases the schedule cleaning period of tube bundle. In this paper, experimental investigation will be carry out for a counter flow tube helical coil heat exchanger where hot and cold water flows through the tube and shell respectively.
and cold water. A calibrated rotameter was used to measure the flow rate of shell side cold water flow.

![Experimental set-up diagram](image-url)

The formulas used to calculate overall heat transfer coefficient ($U_o$), LMTD, Reynolds number ($Re$) and effectiveness ($\epsilon$) are listed below:

\[
Q_{hot} = m_h * C_{ph} * \Delta T_h \\
Q_{cold} = m_c * C_{pc} * \Delta T_c \\
\text{where, } \Delta T_h = T_{hi} - T_{ho} \text{ and } \Delta T_c = T_{ci} - T_{co} \\
U_o = \frac{Q_{avg}}{(Ao * \text{LMTD})} \\
\text{where, } Q_{avg} = \frac{(Q_{hot} + Q_{cold})}{2} \\
\text{LMTD} = \frac{(\Delta T_1 - \Delta T_2)}{\ln (\Delta T_1 / \Delta T_2)} \\
\text{where, } \Delta T_1 = T_{hi} - T_{co} \text{ and } \Delta T_2 = T_{ho} - T_{ci} \\
Re = \frac{(\rho * \nu * D_i)}{\mu} \\
\epsilon = \frac{C_h * (T_{hi} - T_{ho})}{C_{min} * (T_{hi} - T_{ci})} = \frac{C_c * (T_{co} - T_{ci})}{C_{min} * (T_{hi} - T_{ci})} \\
\text{where, } C_h = m_h * C_{ph} \text{ and } C_c = m_c * C_{pc}
\]

Figure 3: Experimental set-up

The tube side hot water flow rate was measured using calibrated vane type flow meter. The inlet and outlet temperatures of hot and cold water were recorded using RTD thermocouples with accuracy of 0.1°C. The tube and shell side thermo-physical properties of water were assessed at their mean temperatures. Table-I shows the specification of helical coil and Table-II shows the operating range of heat exchanger.

Table I: Characteristics dimension of helical coil tube

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turns of helical coil</td>
<td>06 turns</td>
</tr>
<tr>
<td>Inner diameter of coil</td>
<td>10 mm</td>
</tr>
<tr>
<td>Outer diameter of coil</td>
<td>12 mm</td>
</tr>
<tr>
<td>Wall thickness</td>
<td>1 mm</td>
</tr>
<tr>
<td>Stretched length of coil</td>
<td>3334 mm</td>
</tr>
<tr>
<td>Helical diameter of the coil</td>
<td>178 mm</td>
</tr>
<tr>
<td>Fluid used</td>
<td>Water</td>
</tr>
</tbody>
</table>

Table II: Range of operating parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube side water flow rate</td>
<td>0.003 – 0.024 Kg/sec</td>
</tr>
<tr>
<td>Shell side water flow rate</td>
<td>0.004 – 0.0251 Kg/sec</td>
</tr>
<tr>
<td>Tube inlet temperature</td>
<td>55 – 59°C</td>
</tr>
<tr>
<td>Tube outlet temperature</td>
<td>42 – 50°C</td>
</tr>
<tr>
<td>Shell inlet temperature</td>
<td>35 – 37°C</td>
</tr>
<tr>
<td>Shell outlet temperature</td>
<td>44 – 49°C</td>
</tr>
</tbody>
</table>

Table III: Results for various mass flow rate of hot water

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>$\Delta T_1$ (in °C)</th>
<th>$\Delta T_2$ (in °C)</th>
<th>LMTD</th>
<th>$\epsilon$</th>
<th>$U_o$</th>
<th>Re</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19.7</td>
<td>11.3</td>
<td>15.72</td>
<td>0.62</td>
<td>462</td>
<td>2089</td>
</tr>
<tr>
<td>2</td>
<td>17.2</td>
<td>16.9</td>
<td>19.84</td>
<td>0.47</td>
<td>552</td>
<td>4795</td>
</tr>
<tr>
<td>3</td>
<td>15.8</td>
<td>21.8</td>
<td>21.56</td>
<td>0.51</td>
<td>635</td>
<td>6949</td>
</tr>
<tr>
<td>4</td>
<td>13.8</td>
<td>24.5</td>
<td>21.91</td>
<td>0.58</td>
<td>716</td>
<td>7943</td>
</tr>
<tr>
<td>5</td>
<td>21.1</td>
<td>25.6</td>
<td>27.08</td>
<td>0.62</td>
<td>779</td>
<td>9986</td>
</tr>
</tbody>
</table>

V. RESULTS

Figure 4 shows the graph of mass flow rate of hot water Vs effectiveness. It is observed that effectiveness of helical coil heat exchanger initially decreases from 0.62 to 0.52 and it gradually increases as mass flow rate of hot water increases. The effectiveness initially dropdown as hot water capacity rate is less than cold water capacity rate ($C_h < C_c$). When mass flow rate is increased above 72 LPH it is observed that, effectiveness starts to increase as hot water capacity increases. Figure 5 shows the graph of mass flow rate of hot water Vs overall heat transfer coefficient.
It is observed that as mass flow rate of hot water increases the overall heat transfer coefficient of heat exchanger increases. Figure 6 shows the graph of mass flow rate of hot water Vs Reynolds number. According to (3) the Reynolds number is directly proportional to flow velocity. As mass flow rate of hot water increases the Reynolds number increases, this is because flow velocity increases.

VI. CONCLUSION

An experimental investigation was carried out to review the overall heat transfer coefficients and effectiveness of shell and helically coiled tube heat exchangers. It is observed that, once cold water mass flow rate is constant and hot water mass flow rate is increased the overall heat transfer constant will increase. The helical tube permits the water to be in contact for larger period of time in order that there is an enhanced heat transfer compared to that of straight tube. It is also observed that hot water mass flow rate greatly affects effectiveness of heat exchanger. The effectiveness of helical coil heat exchanger gradually increases as flow rate of hot water increases. The overall heat transfer of heat exchangers depends on its LMTD.

REFERENCES


A Model of Employee Well-being for Front-line Employees in Hotel Industry

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Abstract- This paper aims to develop a model of the recently introduced concept of employee well-being for front-line employees in the hotel industry. By introducing the concept of employee well-being for the hotel industry, this article proposes that employee well-being is more likely to be sustainable when employee burnout is low for front-line employees who are supposed to manage their emotions in front of customers. These employees are called as ‘emotional labour’. Also the mediating effect of burnout to the relationship between emotional labour and employee well-being is considered in this article. The stress theory and conservation of resources theory are used to justify the relationships between emotional labour and employee well-being, and emotional labour and burnout. Role identification and social sharing of emotions are proposed as moderators when developing this model.

Index Terms- Employee Well-being, Emotional Labour, and Burnout

I. INTRODUCTION

Today’s organizations are operating in a highly competitive environment which is prone to change in every second. Organizations have identified that people or the human resource of the organization hold the greatest potential to face this continuously increasing competition. When organizations started achieving competitive advantage through employees, they had to look out of the box for finding ways to gear them towards business success. This recognition for employees can be seen among both researchers and practitioners in the field of human resource management mostly as employees are capable of producing organization-level competencies that create sustainable competitive advantage and this asset is expected to be valuable, rare, inimitable, and non-substitutable (Barney, 1991). Thus, recruiting, maintaining, and developing caliber workforce within the organization has become one of the main objectives of Human Resource Management (HRM). Success of HRM depends on how well they achieve objectives of HRM (De Alwis & Kulasekara, 2015) In order to fulfill these criteria, organizations use different ways and in recent years, employee well-being has become one of the most important topics in the field of Human Resource Management.

Human resource is the most precious resource of all the organizations and the mind and emotions differentiate human beings form other living beings. Nowadays, emotions of the employees have become an important part of any customer service job because of the developments of service segment and the raise in the level of employee interaction with customers. The effort they made to regulate their emotions consciously while they are in a service encounter is defined as “emotional labour”, and the job they perform is defined as “emotional labour job” (Hochschild, 1983).

This article focuses the relationship between two different constructs, ‘Emotional Labour’ and ‘Employee Well-being’ and also the mediating effect of burnout of employees. Further, it will look at the moderating effect of role identification and social sharing of emotions on the relationship between emotional labour and burnout and on the relationship between emotional labour and employee well-being respectively.

II. EMPLOYEE WELL-BEING

The well-being of employees is highly concerned by different social groups and organizations at the present time. The workplace has become a significant part of any individual’s life, since it affects his or her both work and personal life and well-being of the society. The average adult expends much of his or her life working, probably two third of his or her life in work.

The ultimate objective of any organization is profit maximization for their owners and customer value proposition (Thompson et al., 2011). Employers who spend a considerable amount of resources in hiring employees and trying to produce quality products and services, maintain loyal customer, and maximizing profit through employees are very much keen about employee well-being (Harter, Schmidt, & Heyes, 2002). Tangible benefits must be provided to succeed in hiring caliber employees. However, studies of modern and future generations of employees reveal that majority of employees prefer to achieve greater meaning and personal development from their job and those studies propose many employees observe their job as a enjoyable, satisfying, and socially useful one (Avolio & Sosik, 1999; Wrzesniewski, McCauley, & Schwartz, 1997). Both employees in the society and employers can be substantially benefitted by promoting well-being among workers than creating strains and mental illness.

According to the service literature satisfied employees create happy and loyal customers to the organizations. But, it is difficult to enhance the level of employee well-being, specially psychological and emotional well-being of employees. The researcher conducted a pilot survey to identify whether this
difficulty exists in Sri Lankan organizations as well. That study was done for the hotel industry, selecting a sample from frontline employees of five-star hotels in Sri Lanka. As per the results of the pilot study, 72% of employees in the Sri Lankan hotel industry showed an impaired well-being while 15% are having an average level of well-being. Only 13% of employee well-being was at a satisfactory level. Hence, it can be said that there is an issue with employee well-being among hotel employees in Sri Lanka. The current study will focus on to fill the identified gap by developing a model of employee well-being for the employees in the hotel industry.

III. EMOTIONAL LABOUR

The concept ‘Emotional labour’ can be defined as “the effort, planning, and control needed to express organizationally desired emotion during interpersonal transactions” (Morris & Feldman, 1996, p.987). Organizations manage emotions by imposing structures on their workforce (Cropanzano, Weiss, & Elias, 2004). Rafaeli and Sutton (1987) referred to these as display rules. A service provider performs emotional labour, complying with display rules through surface acting and deep acting (Hochschild, 1983). Ashforth and Humphrey (1993) claimed that, there is a third form of emotional labor besides deep acting and surface acting. That is spontaneous or genuine emotional labor. According to Hochschild (1979, 1983) service encounters have to perform an emotional role during service transactions. Front-line employees of hotels are more expected to be emotional labour comparing to other service employees, because customers are going to a hotel to buy happiness. Happiness is something intangible and unlimited and also varies from customer to customer. Therefore, the emotional involvement is high for front-line employees working for hotels. This study will mainly focus on the impact of emotional labour on employee well-being.

IV. EMOTIONAL LABOUR AND EMPLOYEE WELL-BEING.

Employee health and well-being at work have become enormous problem during the past few years and the understanding and knowledge about employee well-being and occupational health stemming through all types research has been disseminated speedily throughout the world. As Job Demands–Resources (JD-R) theory explains (Bakker & Demerouti, 2014; Demerouti & Bakker, 2011) employee well-being is a function of the work environment, which has steady but also flexible elements. Most of the studies on employee well-being have focused on physical well-being and psychological well-being of employees. But this study will focus on psychological, physical, emotional, and social well-being of employees.

Hochschild (1979, 1983) introduced three mechanisms by which emotional labour harms employee well-being. Those mechanisms are first, emotional labour may lead to worker alienation; second, emotional regulation takes energy, and third, display rules could produce a conflict of discourse such that individuals have no suitable guide for their actions. Mann (1999) suggested that the level of emotional labour performed by service employees may have negative impacts for their well-being that extends beyond the work context. Humphrey, Ashforth, and Dievendorff (2015) acknowledge that surface acting frequently has negative outcomes for the personal well-being of employees. Some scholars have found that there is an association between surface acting and stress and impaired well-being (Bono & Vey, 2005; Wang, Seibert, & Boles, 2011). Gross (1998) has found that deep acting is positively associated with well-being outcomes. Predict

Conservation of Resources Theory. Conservation of Resources (COR) theory envisages that the primary feature in the stress process is the resource loss (Hobfoll, 2001). COR theory is being successfully employed in foreseeing a series of stress consequences in various organizational situations. According to Hobfoll (2001), set of theories and principals are followed by the COR theory. The basic principal of this theory is that individuals struggle to acquire, maintain, protect and foster the things that they value. They do so in a world that they see as inherently aggressive and requiring a collection of their personal strengths, social attachments, and cultural belonging in order to survive (Greenberg, Pyszczynski & Solomon, 1986 as cited in Hobfoll, 2001). These personal strengths, social attachments, and cultural belonging are termed as resources.

According to the first and most important principle of COR theory, resource loss is disproportionately more prominent than resource gain (Hobfoll, 2001) and it leads to psychological stress. According to services management literature service encounters are in a threat of losing their personal resources. Hochschild (1979) argued that customer service employees are expected to experience and convey certain feelings during service encounters, but that effort to conform to those expectations leads to certain destructive psychological effects among the service agents. Employees who are supposed to display organisationally desired emotions are labeled as ‘Emotional Labour’. When employers try to regulate employees’ emotions during service transactions, employees or emotional labour lose their personal resources such as ‘feeling that I have control over my life’, ‘understanding from my employer’, ‘feeling that I know who I am’, ‘positive feeling about myself’ and etc. which have been introduced by Hobfoll (2001) as personal resources.

In the current study, on the basis of conservation of resources theory, relationship between emotional labour and employee well-being will be examined and it is expected that this relationship will be important to identify the level of employee well-being. With the support of COR theory and existing empirical evidences, the first hypothesis is derived.

$H_1$: There is a negative impact of emotional labour on employee well-being.

V. BURNOUT

The concept ‘burnout’ was introduced by Freudenberger, in 1974. According to him, the symptoms of burnout are decrease in achievement, depersonalization, and the decrease in the interest to the job (Schabracq, Winnubst, & Cooper, 2003). Maslach et al.(2001) defined burnout as “the alienation of the person to the genuine meaning and the purpose of his or her job and being truly not able to attend the people whom he or she delivers service to” (as cited in, Celik et al., 2010. Pg. 49). Maslach et al.
(2001) defined burnout as a three-dimensional concept. The three dimensions are Emotional exhaustion (the stress related fatigue of the individual’s physical and emotional power), depersonalization (development of negative and strict attitudes and behaviors against the people in the service interaction), and personal accomplishment (having emotions of failure and incompetence in the jobs when interacting with the people).

VI. EMOTIONAL LABOUR AND BURNOUT

Today, many researchers focus on conducting studies about burnout as the negative effects of emotional labour. Burnout is probably attached with the customer service employees as they experience high level of stress when emotionally interacting with customers (Jackson et al, 1986). Zapf (2002) found a positive association of burnout with emotional labour. Brotheridge and Grandey (2002) have determined that there is a correlation between emotional exhaustion (one dimension of burnout) and the need to prevent the negative feelings and also they found that there is a negative correlation between surface acting and the sense of personal accomplishment (another dimension of burnout). Zapf (2002) argued that burnout is a kind of warning that employees are no longer able to adequately manage their emotions during service encounters.

Stress Theory. Stress theory generally holds that as major life events and chronic strains accumulate, the individual’s ability to readjust can be overwhelmed, resulting in greater vulnerability to physical or psychological disorders (Brown & Harris, 1978 as cited in Thoits, 1991). According to the proponents of the stress perspective quality of life and performance of workers are hindered by strain or boredom, in other words too much challenge or too little challenge can negatively affect employees (Harter, Schmidh, & Keyes, 2003 as cited in Robertson & Cooper, 2010). Further, they claimed that the existence of positive appraisals and positive emotional states of the worker and his or her relationship within the workplace bring out worker performance and quality of life. Burnout emerges when workers experience stress in the condition of being insufficient in meeting the requirements (Celik et al., 2010).

With the support of stress theory and prevailing empirical evidences, this study argues that customer service employees experience high level of stress as they are supposed to regulate their emotions during service encounters. Thus, the second hypothesis is,

H2: There is a positive impact of emotional labour on burnout.

VII. BURNOUT AND EMPLOYEE WELL-BEING

Burnout can be considered as a long-standing stress reaction of employee that is caused by the continuous exposure to job stress. Since 1996, health and well-being in any employment have become more and more important and well-known issues. Thus, the problems around burnout, fatigue, and strain have received a lot of attention. According to Maslach (1982) the burnout individual’s level of frustration tolerance is lessened, oversensitive, he or she is aggressive, and behaves in an aggressive, unfriendly, and suspicious manner. According to Rosse et al., (1991) burnout employees are having a feeling of failure, insufficiency, and impotence and at the same time low job-related self-esteem. On the organizational level, burnout workers think that they are not appreciated by the respective supervisors and by their colleagues. These arguments prove that burnout can be influenced employee psychological and emotional well-being. Hendrix et al. (1991) found a small but significant association between emotional exhaustion and the frequency of self-reported flu or cold occurrences. Melamed et al. (1999) found high levels of cholesterol in burnt-out workers. Further, they observed lower levels of cortisol in non-burnout employees compared to burnt-out employees. So it is proved that burnout affects employees’ physical well-being.

Based on the prevailing theories, arguments, and empirical evidences the third hypothesis is derived.

H3: There is a negative impact of burnout on employee well-being.

Based on the stress theory and the empirical evidences, a relationship is identified between emotional labour and burnout. The COR theory and prevailing empirical evidences support the argument that there is a relationship between emotional labour and employee well-being. The hypothesis was derived to identify the relationship between burnout and employee well-being based on prevailing arguments and empirical evidences. Therefore, this study tries to identify the mediating role of burnout to the relationship of emotional labour and employee well-being. Hence, based on these arguments the fourth hypothesis of the study is derived.

H4: Burnout mediates the relationship between emotional labour and employee well-being.

VIII. ROLE IDENTIFICATION

Thoits (1986) defines roles as the ‘scripts’ for performing particular positions. Thus, role identities are helpful to define who one is, and also give directions for an individual that how he or she is supposed to behave within a given position. Therefore, roles and role expectations must give a meaning, purpose, and direction to one’s life. Ashforth and Humphrey (1993) suggested that emotional labour gives an opportunity to “act out” one’s identification, that is, to convey one’s loyalty to the valued identity. Emotions are vital to what we experience in the workplace and as well as in self (Elfenbein, 2007) and in a nutshell, are a measure for identity. Humphrey et al. (2015) argue that a valued identity can be upheld and reinforced through surface and, especially, deep acting and thereby surface and deep acting facilitate the sense that one is actually being true to oneself. Individuals usually need to suppose that the work they perform is meaningful and reflect who they are (identity). Humphrey et al. (2015) further argue that employee who identifies with a role is motivated to suddenly feel the expected or required emotions and the more they do, the more their identity is confirmed and employees may willingly engage in surface and deep acting and regard the attendant emotional dissonance and exhaustion as signs of their commitment. Finally, the more that an employee perceives a role as significant and reflecting a valued identity, the more prepared the employee is to

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engage in emotional labor in order to accomplish role expectations. Individuals who perceive a poor fit between their employment and themselves, and who do not identify with their jobs, are likely to come across their occupations stressful and do them unsuccessfully (Humphrey et al., 2015). Based on these arguments the fifth hypothesis is derived

\[ H_5: \text{Role identification will moderate the positive impact of emotional labour on burnout such that the positive impact will be lower when role identification is high} \]

**IX. SOCIAL SHARING OF EMOTIONS**

Customer service employees who perform emotional labour role regulate their emotions during service encounters. As discussed earlier, regulation of emotions as a part of their job everyday affects the level of well-being of these employees. But as Rime et al. (1998) pointed out these employees can communicate the personal experience of emotional event with others and they coined it as ‘social sharing of emotions’. According to the findings of Rime et al. (1998) and Gable et al. (2004), spouses, other family members and friends were usually the targets of emotion sharing incidents in the personal domain. Similarly, coworkers or peers are the targets for the sharing of emotions at work (Beehr et al., 2003; Daniels et al., 2008). Thoits (1984) also claims that human beings need others who are socially parallel to themselves in dealing with peak emotions, those who can support by providing ‘empathetic understanding’ by having experienced the similar types of situations and responses. Therefore, it is clear that employees who perform emotional labour role can reduce the negative impacts of emotional labour through sharing of emotions with others. Thus, the sixth hypothesis of the study can be derived as follows.

\[ H_6: \text{Social sharing of emotions will moderate the negative relationship between emotional labour and employee well-being, such that the relationship will be weaker when social sharing of emotions is high} \]

**X. OVERALL MODEL OF EMPLOYEE WELL-BEING FOR FRONT-LINE EMPLOYEES IN HOTEL INDUSTRY**

The previous studies regarding antecedents of employee well-being, and the facts available in the service management literature can be used in an overall model of employee well-being. In the current study, one relationship has been developed, between emotional labour and employee well-being based on conservation of resources theory. The relationship between emotional labour and well-being is moderated with social sharing of emotions and it is expected that employee well-being can be uplifted when they share their emotions with family members and co-workers. The second relationship has been developed between emotional labour and burnout based on stress theory. That relationship is expected to be modified with the moderating effect of role identification in order to have minimized level of burnout when the front-line employees are continuously performing as emotional labour. Based on the first and second relationships, burnout has been identified as a mediator to the relationship between emotional labour and employee well-being.

*Figure 1 shows the overall model of employee well-being which has been developed for front-line.*

![Overall Model of Employee Well-being](image-url)
REFERENCES


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Research of one problem of pursuit with different constraints on controls

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Abstract - We consider the pursuit problem for the so-called game “boy and crocodile”. “Boy” is moving in according to the equation \( \dot{y} = v \), “crocodile” moving according to the equation \( \ddot{x} = u \) and “boy” can not leave the closed ball of radius \( R > 0 \). Control of the pursuer is subjected to integral constraint, and the evader’s control is subjected to geometric constraint. Sufficient conditions of completion of pursuit from all initial positions are obtained.

Key words: differential games, boy and crocodile, Cauchy problems, integral constraint, geometric constraint, phase vector.

I. INTRODUCTION

The problem of pursuit and escaping in differential games with different constraints on controls are investigated in many works, for example [1-24]. From them in [10, 13] describes the main approaches for solving differential pursuit-evasion games and obtained basic results. In recent years one of the low-studied areas of the theory of differential games - differential games with integral [3,9,10,13,14,18-24] and different [3-6,21] constraints on controls is widely investigated. In works [1,2,4-8,9,11,13,16,17,24] the differential games of pursuit-evasion of different structure are studied with phase constraints on the state of players. This article is sanctified to the decision of problem of pursuit for the so-called game "boy and crocodile" with different constraints on the controls of players. In the present we investigated the case with integral constraints on the control of the pursuer (crocodile) and geometric constraints on the control of the evader (boy), in the case of phase constraints on the state of the evader. In this case, at the decision of problem of pursuit from all initial positions of phase space, a pursuer runs into the problem of the reasonable use of limit resources of pursuit. For the decision of this problem, the idea of work [4,17,18] in-process is used, according to that at first the phase vector of pursuer is driven to the certain set, taking no notice on behavior of escaping player, and then using the control of escaping and initial positions of players, the control of pursuer, guaranteeing completion of
pursuit, is built. The sufficient conditions of completion of pursuit from all initial positions are obtained. Work joins to researches \[4-6, 17, 21\]

Consider the so-called differential game "boy and crocodile" described by the equations:

\[
\begin{align*}
\text{a)} & \quad \dot{x} = u, \\
\text{b)} & \quad \dot{y} = v
\end{align*}
\]

where \( x, y \in \mathbb{R}^n \) - the phase vectors, \( u, v \in \mathbb{R}^n, n \geq 1 \) - the control parameters of pursuit and evasion, respectively. The pursuer (crocodile) moves according to the equation (1a), evader (boy) moves according to the equation (1b). Control parameters \( u, v \) selected from the class of measurable functions satisfying according to integral (2) and geometric (3) constraints, respectively:

\[
\int_0^\infty |u(t)|^2 dt \leq \rho^2, \quad (1.2)
\]

\[
|v| \leq \sigma. \quad (1.3)
\]

The boy is trapped crocodiles, if at some moment \( t_1 > 0 \) the inequality \( |y(t_1) - x(t_1)| \leq \ell \) is hold, where \( \ell > 0 \) – the given positive constant number, while the boy all the time must be in the closed ball \( RS \) where, \( R \) -given positive number, \( S = \{ z \in \mathbb{R}^n : |z| \leq 1 \} \). By setting the initial point \( x(0) = x^0, \dot{x}(0) = x^0_1, y(0) = y^0 \), defining measurable functions \( u = u(t), \quad v = v(t), \quad 0 \leq t < \infty \), and introducing the notation \( z_1 = x, \quad z_2 = \dot{x} \), from (1) will get the next linear Cauchy problems:

\[
\begin{align*}
\dot{z}_1 &= z_2, \\
\dot{z}_2 &= u(t), \quad z_1(0) = z_{10} = x^0, \\
\dot{z}_1 &= u(t), \quad z_2(0) = z_{20} = x^0_1.
\end{align*}
\]

\[
\dot{y} = v(t), \quad y(0) = y^0. \quad (1.5)
\]

For the solution of Cauchy problems (4), (5) the following formulas is hold

\[
z_2(t) = z_{20} + \int_0^t u(\tau) d\tau, \quad z_1(t) = z_{10} + t z_{20} + \int_0^t (t - \tau) u(\tau) d\tau, \quad (1.6)
\]

\[
y(t) = y^0 + \int_0^t v(\tau) d\tau. \quad (1.7)
\]

**Definition 1.** Measurable functions \( u = u(t), \quad v = v(t) \), \( 0 \leq t < \infty \), satisfying to constraints (2), (3) are called admissible control of pursuers and evader respectively.

**Definition 2.** We say that pursuit can be completed in differential game (1)-(3) from initial positions \( z_{10}, z_{20}, y^0 \), \( |z_{10} - y^0| > \ell \), at the time \( t_1 > 0 \), if for any admissible control of the evader
\[ v = v(t), \quad 0 \leq t < t_1, \] it is possible to find an admissible control \( u = u(t), \quad 0 \leq t < t_1, \) of the pursuer, such that for the solutions \( z_1(t), y(t), \quad 0 \leq t \leq t_1, \) corresponding Cauchy problems (4), (5) the inclusion \( |y(t) - z_1(t_1)| \leq \ell \) is holds and \( y(t) \in RS, \quad 0 \leq t \leq t_1. \)

**Problem.** Find sufficient conditions of pursuit.

**Condition 1.** There are numbers \( \ell_1 > 0, \ell_2 > 0, \), \( \rho_3 > 0 \) such, that \( \ell_1 + \ell_2 = \ell \) and \( \rho - \rho_3 > \frac{\sigma}{ac} \sqrt{t_3(R, \rho_3)} \), where \( t_3(R, \rho_3) \) first positive root of the equation

\[
R + tR = \frac{t}{2} \rho_3, \quad \alpha = \frac{R}{R - \ell}, \quad c = \frac{2\alpha \ell_1}{\sigma}.
\]

**Theorem 1.** If condition 1 is hold true, then pursuit can be completed in the game (1)-(4) from all points \( z_{10}, z_{20}, y^0, |z_{10} - y^0| > \ell, \) for a finite time.

**Proof.** A. In this point A we will prove that choosing a measurable control \( u = u(t), \quad t \geq 0, \) \( \int_0^t |u(t)|^2 \, dt \leq \rho_1^2 + \rho_2^2, \) phase vector \( z(t) = (z_1(t), z_2(t)), \quad t \geq 0, \) going out at \( t = 0 \) from a point \( z_0 = (z_{10}, z_{20}), |z_0| > R, \) it can lead to the set \( RS \) at some time \( t_2, \quad 0 < t_2 < \infty, \) where \( \rho_1 > 0, \rho_2 > 0, \) are chosen from the condition \( \rho - \rho_3 - \rho_1 - \rho_2 > \frac{\sigma}{ac} \sqrt{t_3(R, \rho_3)}. \) By the continuity of the condition 1 should be the choice of such numbers \( \rho_1 > 0, \rho_2 > 0. \)

We will put \( t_1 = \frac{|z_{20}|^2}{\rho_1^2}, \quad u(t) = u_1(t) = \frac{u_0}{\sqrt{t_1}} = -\frac{z_{20}}{\sqrt{t_1} |z_{20}|} \rho_1, \quad 0 \leq t \leq t_1, \) and from the second equality of formulas (6) we have

\[
\begin{align*}
  z_2(t_1) &= z_{20} - \sqrt{t_1} \frac{z_{20}}{|z_{20}|} \rho_1 = z_{20} + \sqrt{t_1} u_0 = 0. \\
  z_1(t_1) &= z_{20} + t_1 z_{20} + \frac{t_1^2 u_0}{2 \sqrt{t_1}} = z_{10} + t_1 z_{20} + \frac{t_1 \sqrt{t_1} u_0}{2}.
\end{align*}
\]

Agree (8) \( \sqrt{t_1} u_0 = -z_{20}, \) therefore from the last equation we have equality

\[
z_1(t_1) = z_{10} + t_1 z_{20} - \frac{t_1}{2} z_{20} = z_{10} + \frac{t_1}{2} z_{20};
\]

Now moment \( t = t_1, \) is taken as the initial time for the game and we will put

\[
\begin{align*}
  z_1(0) &= z_1(t_1), \quad t_2 = \sqrt{\frac{4 |z_2|^2}{\rho_2^2}}, \quad u(t) = u_2(t) = \frac{u_0}{\sqrt{t_2}} = -\frac{z_1^0}{\sqrt{t_2} |z_1^0|^2} \rho_2, \quad 0 \leq t \leq t_2.
\end{align*}
\]

Further, using equalities \( z_2(t_1) = 0 \) and (6) we have
\[ z_1(t_2) = z_1^0 - \frac{t_2 \sqrt{t_1 \rho_2}}{2 z_1^0} z_1^0 = z_1^0 + \frac{t_2 \sqrt{t_2}}{2} u_1^0 = 0 \]

or \( \sqrt{t_2} u_1^0 = -\frac{2}{t_2} z_1^0 \).

Then for \( z_2(t_2) \) using equality \( z_2(t_1) = 0 \) from (6) we have

\[ z_2(t_2) = \sqrt{t_2} u_1^0 = \frac{2}{t_2} z_1^0 = \frac{2}{t_2} (z_{10} + t_1 z_{20}) = \frac{2}{t_2} z_{10} + \frac{2t_1}{t_2} z_{20}. \]

If it is necessary, in (9) we decrease \( \rho_2 > 0 \), what means increase \( t_2 \), and we try to get implementation of inequality \( |z_2(t_2)| = \left| \frac{2}{t_2} z_{10} + \frac{2t_1}{t_2} z_{20} \right| \leq R \). Thus at the moment \( t_2 \) we have \( z_1(t_2) = 0, |z_2(t_2)| \leq R \), what means \( |z(t_2)| \leq R \).

B. Consider the equation \( R + tR = \frac{t \sqrt{t}}{2} \rho_3 \) with respect to unknown \( t, t > 0 \). As \( R > 0 \), \( \rho_3 > 0 \) - the finite number and the right side of the equation is growing faster than the left side with respect to \( t \), that obviously this equation has a positive root, depending only on \( R, \rho_3 \). The first positive root of this equation we will denote through \( t_3(R, \rho_3) \). Further, if \( t_4 \) first positive root of the equation

\[ |a - tz_{20}| = \frac{t \sqrt{t}}{2} \rho_3 \]

according to \( a, z_{20} \in R^n, |a| \leq R, |z_{20}| \leq R \), that is clear that for such vectors \( a, z_{20} \) have a place of inequalities: \( |a - tz_{20}| \leq R + R t \),

\[ t_4 \leq t_3(R, \rho_3). \]  \hspace{1cm} (1.11)

We will consider inclusion

\[ a - tz_{20} \in \int_0^t (t - \tau) \frac{\rho_3}{\sqrt{t}} Sdt. \]  \hspace{1cm} (1.12)

The radius of the ball on the right side (12) is equal to \( r(t) = \frac{t \sqrt{t}}{2} \rho_3 \), so comparing it with equation (10) we find that for \( t = t_4 \) inclusion (12) is hold first runs.

Now consider the equation

\[ a - tz_{20} \in \int_0^t \frac{\rho_3}{\sqrt{t}} Sdt. \]  \hspace{1cm} (1.12)

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\[ a - t_4 z_{20} = \int_{0}^{t_4} (t_4 - \tau) \frac{P_3}{\sqrt{t_4}} \omega d\tau, \]  

(1.13)

with respect to unknown vector \( \omega \in S \). At \( t = t_4 \) inclusion (12) is executed that provides existence of the solution of the equation (13). The solution of equation (13) is denoted by \( \omega_0 \). C. We now describe the method of pursuit and estimate the \( \|y(t) - z(t)\| \) at a some moment of time. Let given initial points: \( z_{10}, z_{20}, y^0 \in R^n, \|y^0 - z_{10}\| > \ell, \|y^0\| \leq R \). Then possible the following cases:

1) \[ \frac{1}{\alpha} y^0 - z_{10} \leq R, \quad |z_{20}| \leq R, \]
2) \[ \frac{1}{\alpha} y^0 - z_{10} > R, \quad |z_{20}| > R, \]
3) \[ \frac{1}{\alpha} y^0 - z_{10} > R, \quad |z_{20}| \leq R, \]
4) \[ \frac{1}{\alpha} y^0 - z_{10} \leq R, \quad |z_{20}| > R. \]

At 1) case the control of pursuit we will choose in the form

\[ u(\tau) = u_3(\tau) = \begin{cases} 
\frac{1}{\alpha} v(\tau) + \frac{\rho_3}{\sqrt{t_4}} \omega_0, & 0 \leq \tau \leq t_4 - c, t_4 > c, \\
\frac{1}{\alpha c} v(\tau) + \frac{\rho_3}{\sqrt{t_4}} \omega_0, & t_4 - c \leq \tau \leq t_4, t_4 > c, \\
\frac{1}{\alpha c} v(\tau) + \frac{\rho_3}{\sqrt{t_4}} \omega_0, & 0 \leq \tau \leq t_4, t_4 \leq c, 
\end{cases} \]

(1.14)

where \( \omega_0, t_4 \) are defined according to point B, \( \omega_0 \) - solution of equation (13), \( t_4 \) the first positive root of the equation (10) according to vector \( a = \frac{1}{\alpha} y^0 - z_{10} \). Then considering, that in process game "a boy" does not can to leave a sphere \( RS \), for the \( \|y(t) - z(t)\| \) of the solutions (6), (7), we have

\[ \frac{1}{\alpha} y(t_4) - z_1(t_4) = \frac{1}{\alpha} y^0 - z_{10} - t_4 z_{20} - \int_{0}^{t_4} (t_4 - \tau) \frac{P_3}{\sqrt{t_4}} \omega_0 d\tau + \frac{1}{\alpha} \int_{t_4 - c}^{t_4} \left(1 - \frac{t_4 - \tau}{c}\right) \frac{\alpha}{\alpha c} v(\tau) d\tau \]

= \frac{1}{\alpha} \int_{t_4 - c}^{t_4} \left(1 - \frac{t_4 - \tau}{c}\right) v(\tau) d\tau \leq \frac{\alpha c}{2\alpha} = \ell_4,

\[ \|y(t_4) - z_1(t_4)\| = \|y(t_4) - \frac{1}{\alpha} y(t_4) + \frac{1}{\alpha} y(t_4) - z_1(t_4)\| \leq \ell_4. \]

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\[
\left(1 - \frac{1}{\alpha}\right)\left| y(t_4) \right| + \left| \frac{1}{\alpha} y(t_4) - z_1(t_4) \right| \leq \left(1 - \frac{1}{\alpha}\right)R + \ell_1 = \ell_2 + \ell_1 = \ell.
\]

In this way, it is proven that the moment \( t_4 \) game is over. Further, we prove the admissibility of pursuit control (14):

\[
\int_0^{t_4} \left| u_1(\tau) \right|^2 d\tau \leq \int_0^{t_4} \left| \frac{1}{\alpha(t_4 - \tau)} v(\tau) + \frac{\rho_3}{\sqrt{t_4}} \omega_0 \right|^2 d\tau + \int_0^{t_4} \left| \frac{1}{\alpha c} v(\tau) + \frac{\rho_3}{\sqrt{t_4}} \omega_0 \right|^2 d\tau \\
\leq \int_0^{t_4} \left( \frac{1}{\alpha c} v(\tau) + \frac{\rho_3}{\sqrt{t_4}} \omega_0 \right)^2 d\tau \leq \left( \int_0^{t_4} \left( \frac{1}{\alpha c} v(\tau) \right)^2 d\tau \right)^{\frac{1}{2}} \left( \int_0^{t_4} \left( \frac{\rho_3}{\sqrt{t_4}} \omega_0 \right)^2 d\tau \right)^{\frac{1}{2}} \\
\leq \left( \frac{\sigma}{\alpha c} \sqrt{t_4} + \rho_3 \right)^2 \leq \left( \frac{\sigma}{\alpha c} \sqrt{t_3(R, \rho_3)} + \rho_3 \right)^2 < \rho^2.
\]

In the 1) case, proof of the theorem 1 is completed. In other cases 2), 3), 4) proposed the following method of pursuit: at the beginning of the game, we will control the phase vectors \( z_i(t) \), \( z_2(t) \) according to point A, and define the time \( t_2 > 0 \), such that \( z_1(t_2) = 0, \left| z_2(t_2) \right| \leq R \). Further, according to the constraint on the state of the evader we have inequality \( \left| y(t_4) \right| \leq R \). Therefore, if at the beginning of the game we will take time \( t_2 \) and put \( y_0 = y(t_2), z_{10} = z_1(t_2), z_{20} = z_2(t_2) \), we are in the conditions of application of case 1). Further, using the control method of the case 1) argue that there \( t'_4 \leq t_3(R, \rho_3) \), for which \( \left| y(t'_4) - z_1(t'_4) \right| \leq \ell \). Unlike the case of 1) in the three other cases, we choose the numbers \( \rho_1, \rho_2 > 0 \) satisfying the inequality (see point. A)

\[
\rho - \rho_3 - \rho_1 - \rho_2 > \frac{\sigma}{\alpha c} \sqrt{t_4(R, \rho_3)}
\]

According to point A such a choice is possible. In these cases, to complete the game pursuer need used \( t_1 + t_2 + t'_4 \) time, and control of the pursuer has the form

\[
u(\tau) = \begin{cases} u_1(\tau), & 0 \leq \tau \leq t_1, \\
u_2(\tau), & t_1 \leq \tau \leq t_2, \\
u_3(\tau), & t_2 \leq \tau \leq t'_4. \end{cases}
\]

Therefore, from the construction of the point A and C for implementations \( u_1(\tau), 0 \leq \tau \leq t_1, u_2(\tau), t_1 \leq \tau \leq t_2, u_3(\tau), t_2 \leq \tau \leq t'_4 \), of the pursuit control \( u(\tau), 0 \leq \tau \leq t'_4 \), we have:

\[
\int_0^{t_1} \left| u_1(\tau) \right|^2 d\tau \leq \rho_1^2, \\
\int_{t_1}^{t_2} \left| u_2(\tau) \right|^2 d\tau \leq \rho_2^2, \\
\int_0^{t'_4} \left| u_3(\tau) \right|^2 d\tau \leq \left( \rho_3 + \frac{\sigma}{\alpha c} \sqrt{t_4(R, \rho_3)} \right)^2.
\]

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that proved the admissibility of pursuit control in cases 2), 3), 4). Theorem 1 has been proved.

**Condition 2.** There are numbers \( \ell_1 > 0, \ell_2 > 0 \) such that \( \ell_1 + \ell_2 = \ell \) and

\[
\rho > \rho_0 + \frac{\alpha}{c} \sqrt{\frac{4R^2}{\rho_0^2}} \quad \text{at} \quad \rho_0 = \frac{32\alpha^3 R^2}{27\alpha^3 c^3}, \text{where} \quad \alpha = \frac{R}{R - \ell_2}, \quad c = \frac{2\alpha\ell_1}{\sigma}.
\]

**Theorem 2.** If the condition 2 is hold true, then pursuit can be completed in the game (1) - (3) from all initial points \( z_{10}, z_{20}, y^0, |z_{10} - y^0| > \ell \), for a finite time. The proof of theorem 2 is carried out by the scheme of proof of theorem 1 it is easy to change. It should be noted that theorem 1,2 are complementary, i.e., if we apply the theorem to the game (1) - (3) for one and the same starting point, then, by theorem 1, the game can be completed in less time than by theorem 2, but uses more resources than theorem 2.

**Comment 1.** The proof of theorem 1 it follows that if the condition 1 is hold true, then condition 2 is hold true.

**Comment 2.** The same problem for the general linear games research and solved in [6]. But to research this game does not use the method of [6], as unfulfilled assumption 6 of [6].

**ACKNOWLEDGEMENT**

I wish to thank Professor Asqar Rakhmanov under Department of Systematic and Practical Programming for his support over the period in which this paper was written. I also express my gratitude to my parents for their encouragement and my colleagues for their constant cooperation. I would like to express my gratitude towards my college, Hanyang University, for giving me the opportunity to make its facilities available for me.

**CONCLUSION**

This paper proposed a new method based on a differential game. In recent years one of the low-studied areas of the theory of differential games with integral and different constraints on controls are widely investigated. According to the above section, this system can better highlight to the decision of the problem of pursuit for the so-called game "boy and crocodile" with different constraints on the controls of players. In the present, we investigated the case with integral constraints on the control of the pursuer (crocodile) and geometric constraints on the control of the evader (boy), in the case of phase constraints on the state of the evader.

Our future work is to develop more accurate and efficient differential games. We are going to implement our application for visually impaired people to assist them in easily realizing natural scene games.
REFERENCES


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Overview of Degrading Agriculture in Jaunpur branch Canal Command: A GIS/Remote Sensing Based Approach

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Abstract - This paper discusses the pilot study area between the Gomti and Sai Rivers 550000 ha. The entire study area is commanded by the Jaunpur Branch canal with 123-cumec design capacity under the Sarda Sahayak system. In the study geo-database has been prepared based on data collection and to capture information on climate, agriculture, surface and groundwater hydrology, irrigation and drainage network, water demands (Irrigation, domestic, industrial, hydropower, environment), socio-economic and demographic details, topography, water quality etc. The finding reveals that apart from canals, a significant amount of groundwater resources is also being utilized by private and government tubewells. Contribution of government tubewells is much less. Waterlogging appears to be localized in nature and exists predominantly in canal head and middle reaches where groundwater utilization is comparatively less and seepage from canals is higher. It is clear from these illustrations that rice being less sensitive to waterlogging, it exhibits higher productivity in head and middle reaches of canal where canal supply is adequate and reliable in the Kharif. Quite expectedly, it shows lower productivity in the canal tails and out of command areas as canal irrigation is either not available or unreliable. Wheat scenario suggests that the productivity is higher in middle and tail reaches where waterlogging is less and groundwater is used more. The cropping intensity during both Kharif and Rabi seasons is comparatively low along head reaches of canals. RS analyses clearly suggest that cropping intensity is lesser especially along branch and distributary canals in head and middle reaches.

Index Term: Gaghra-Gomti Basin, Waterlogging, crop intensity, Conjunctive use and Demographic

I. INTRODUCTION

Over the past decades the satellite based techniques and the use of remotely sensed data have achieved a major progress and is now becoming a promising approach in wider range of disciplines. Remote sensing is the science and art of obtaining information about an object, area or phenomenon on the earth surface without being in contact with it (Agyepong, 1988, Agyepong and Kufogbe, 1997). The technique, according to Benneh (1997), overcomes the two major problems inherent in ground survey, that is, area coverage and time. GIS is a too! For collecting, storing, retrieving at will, transforming, and displaying spatial data from the real world for a particular set of purposes (Bourrough, 1986). As a database system, it facilitates spatial data indexing and enables the performance of sets of operations to answer queries about spatial entities in the database (Smith et a/., 1987). The GIS technique has, thus, become very useful aiding decision making in planning and development, including irrigation and agriculture.

The most populous state, Uttar Pradesh, is also endowed with the largest water resources in the country. A large network of perennial rivers contributes to its vast water resources potential and
provides drainage to the state (Figure 1). Also, a deep alluvial aquifer underlies the vast plains, recharged annually by almost 1000 mm monsoon rainfall. Over the years, one of the world’s largest irrigation systems has been developed in the state to support predominantly a rice-wheat crop cycle.

Agriculture in the state is currently threatened by sustained water-logging and consequent soil salinity and sodicity in canal command. Under the UP Water Sector Restructuring Project (UPWSRP) of the World Bank, SMEC International Australia commissioned to develop the GIS-based knowledge base of the Gaghra-Gomti (GG) basin and Decision Support System (DSS) for basin management plan of the entire GG basin. There are four major canal systems in the GG basin: Sarda, SardaSahayak, Saryu and Gandak. This paper deals only with the about 550000-ha pilot study area between the Gomti and Sai Rivers (Figure 2). The entire study area is commanded by the Jaunpur Branch canal with 123-cumec design capacity under the SardaSahayak system. The soil is mainly dominated by fine clay loams with flat topographic features having poor surface and sub-surface drainages.

II. MATERIAL AND METHODS

STUDY AREA

Jaunpur Canal is a branch canal of the SardaSahayak Feeder Canal System of about 650 comecs capacity, off-taking from the Sarda River and fed by Sarda Link Channel of 480 cumecs capacity from the Ghaghra River. The 123-cumecs Jaunpur Branch canal irrigates about 3 lakh ha between the Gomti and the Sai Rivers. Nevertheless, the gross command area, which can be irrigated from the Jaunpurofftake, is about 542000 ha of the Gomti-Sai doab. The Jaunpur branch canal system (figure 2) covers a Culturable Command Area of 2,75,000 ha in districts Barabanki, Raebarely, Sultanpur, Pratapgarh and Jaunpur of the State of Uttar Pradesh.

The head discharge capacity of the Jaunpur branch is 123.2 cumec. The salient features of the canal systems of Jaunpur branch canal command are:

(i) Head discharge Capacity - 123.2 Cumec,
(ii) Length of Jaunpur branch – 119.45 km,
(iii)Gross Command Area – 5.54 lakh ha,
(iv) Culturable Command Area – 2.75 lakh ha,
(v) Distributary and minor canal system.
Figure 1 River network in UP state of India
III. METHODOLOGY

A comprehensive geo-database has been prepared to capture information on climate, agriculture, surface and groundwater hydrology, irrigation and drainage network, water demands (irrigation, domestic, industrial, hydropower, environment), socio-economic and demographic details, topography, water quality and so on.

IV. RESULTS AND DISCUSSION

Crop Productivity

NyayaPanchayat-wise productivity data of major crops show similar trends as the previous dataset, with general low productivity over the JBS project area. In particular, the agricultural productivity of water logged areas is very poor. An example is TalaNyayaPanchayat in Amethi Block, Sultanpur, where the productivity of Rice and Wheat is only 17.37 Q/ha and 18.40 Q/ha, respectively, in 2013-14. Over the areas of deeper ground water level where irrigation is taken from both canal water and tubewell water, major crop productivity is higher. For instance, in NyayaPanchayat of Lubhawa Block, Sultanpur, the Rice yield is recorded at 28.18 Q/ha and in NarendrapurPanchayat of Jamu Block, Sultanpur, the Wheat yield is recorded at 30.38 Q/ha.

Generally, the average productivity of major crops in JBS sub-basin is:

- Rice: 18.68 to 23.29 Q/ha
- Wheat: 20.39 to 29.06 Q/ha
- Barley: 11.24 to 18.58 Q/ha
- Gram: 9.46 to 28.92 Q/ha
- Arhar: 12.49 to 9.11 Q/ha
- Mustard: 6.59 to 11.96 Q/ha

Productivity maps of rice and wheat crops have been prepared based on NyayaPanchayat level crop cutting experiment data of JBS area obtained from the Agriculture Directorate of UP and shown in figure 3 and figure 4 respectively. It is clear from these illustrations that rice being less sensitive to waterlogging, it exhibits higher productivity in head and middle reaches of canal where canal supply is adequate and reliable in the Kharif. Quite expectedly, it shows lower productivity in the canal tails and out of command areas as canal irrigation is either not available or unreliable.
Moreover, it is unaffordable to use groundwater for rice and as a result, farmers usually avoid using it for rice. However, according to 2013/14 crop cutting data, average rice productivity of JBS is about 18.68 to 23.29 quintals/ha. This value is even less than the state and national averages of 19.06 and 25.00 quintals/ha respectively (sources). Reason for low productivity attributes more to persistent waterlogging in canal head and middle reaches leading to degraded soil health (Figure 7). This reflects in soil salinity and sodicity in canal command (Figure 8). This clearly suggests the degraded scenario of irrigated agriculture.

Similarly, wheat scenario suggests that the productivity is higher in middle and tail reaches where waterlogging is less and groundwater is used more. In contrast, this is comparatively low in head reaches in spite of higher availability of canal irrigation. This is due to degraded soil and waterlogging delays wheat sowing. According to wheat crop cutting data of 2013/14, the average productivity of wheat in JBS pilot area is about 20.39 to 29.06 quintals/ha. The above values are consistent with the state average but very low as compared to other States, such as Haryana, Punjab and West Bengal.

Figure 3. Rice productivity in JBS pilot study area
Groundwater Levels and Utilization Pattern

Under the UPWSRP program, the UP Irrigation Department recently installed more than 475 piezometers with Automatic Digital Water Level Recorders (ADWLR) to monitor groundwater levels in JBS. Groundwater level data of post-monsoon 2011 as obtained from piezometers were used to plot the depth to groundwater map of the entire sub-basin (Figure 5). Apart from canals, a significant amount of groundwater resources is also being utilized by private and government tubewells. Contribution of government tubewells is much less. Table 1 and figure 6 shows the density of shallow private tubewells in the pilot area based on 2013/14 NIC data. ArcGIS 9.1 software was used for mapping. These two illustrations suggest a distinct correlation between tubewell density and waterlogging. Groundwater utilization is more in canal tails and out of canal command where canal supply is either non-existent or very irregular. Waterlogging appears to be localized in nature and exists predominantly in canal head and middle reaches where groundwater utilization is comparatively less and seepage from canals is higher (Bhakar, 2007).

Table 1- Details of Shallow Tubewells in JBS(2011 Census)

<table>
<thead>
<tr>
<th>Sub-basin</th>
<th>Total</th>
<th>Diesel</th>
<th>Electric</th>
<th>Manual</th>
<th>Solar</th>
<th>Wind-mill</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>JBS</td>
<td>1,29,605</td>
<td>1,10,406</td>
<td>17,143</td>
<td>858</td>
<td>45</td>
<td>817</td>
<td>336</td>
</tr>
</tbody>
</table>
**Sub-surface Waterlogging**

Yield Response Equations to groundwater depth for various crops from Maas and Hoffman 1977 are:

- Oilseed and Sugarcane: \[ Y = -0.220 D^2 - 1.013 D \]
- Wheat: \[ Y = -0.512 D^2 - 1.439 D \]
- Maize: \[ Y = -0.750 D \]
- Gram and Barley: \[ Y = -0.956 D \]

Where:

\[ D = \text{Groundwater depth below natural surface (e.g. } y = -0.15m) \]
\[ Y = \text{Constrained yield divided by unconstrained yield, e.g. 0.6 means that only 60\% of the 'unconstrained' yield will be realised. In cases where the yield computed from the equation exceeds 100\%, then the yield is taken as 100\%}. \]

Yield reductions for various crops due to sub-surface water-logging were also reported by Mott McDonald (1998). For the purposes of this study, Mott McDonald’s table has been extended to incorporate several references they cite in their report (Table 2).
Table 2: Yield Reduction Due to Shallow Water table

<table>
<thead>
<tr>
<th>Depth to water table (m)</th>
<th>Constrained yield compared to unconstrained yield (%)</th>
<th>Oilseed</th>
<th>Sugar</th>
<th>Wheat</th>
<th>Maize</th>
<th>Gram</th>
<th>Barley</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.30</td>
<td></td>
<td>15</td>
<td>15</td>
<td>23</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>0.30-0.45</td>
<td></td>
<td>34</td>
<td>34</td>
<td>51</td>
<td>26</td>
<td>31</td>
<td>31</td>
<td>47</td>
</tr>
<tr>
<td>0.45-0.60</td>
<td></td>
<td>46</td>
<td>46</td>
<td>65</td>
<td>37</td>
<td>47</td>
<td>47</td>
<td>min 80</td>
</tr>
<tr>
<td>0.60-0.75</td>
<td></td>
<td>58</td>
<td>58</td>
<td>76</td>
<td>48</td>
<td>63</td>
<td>63</td>
<td>100</td>
</tr>
<tr>
<td>0.75-0.90</td>
<td></td>
<td>68</td>
<td>68</td>
<td>min 85</td>
<td>59</td>
<td>min 80</td>
<td>min 80</td>
<td>100</td>
</tr>
<tr>
<td>0.90-1.00</td>
<td></td>
<td>78</td>
<td>78</td>
<td>91</td>
<td>70</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1.00-1.20</td>
<td></td>
<td>87</td>
<td>87</td>
<td>96</td>
<td>min 80</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1.20-1.50</td>
<td></td>
<td>95</td>
<td>95</td>
<td>99</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<tr>
<td>1.50-1.80</td>
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<td>99</td>
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<td>100</td>
<td>100</td>
<td>100</td>
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<td>100</td>
</tr>
<tr>
<td>&gt;1.80</td>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Adapted from Mott and Anderson (1988)

**Salinity and Sodicity**

In the DSS, crop yields are adjusted to reflect the adverse effect of soil salinity and sodicity. This
adjustment is made in accordance with relationships for plant responses to salinity and sodicity published in McWilliam (1986), Katerji et al.,(1992), Katerji et al., (2003), and Ayres (1997) for salinity, and El Swaify (2000) for sodicity. For the purposes of this study, the results of these papers have been combined, summarised and are presented in Table 3 and Table 4. In a broader category, the yield reduction due to soil sodicity and salinity has been observed to be as given in Figure 7 and Figure 8.

Table 3: Yield Reduction Due to Soil Salinity

<table>
<thead>
<tr>
<th>ECe (dS/m)</th>
<th>Relative yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wheat</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>38</td>
</tr>
<tr>
<td>8</td>
<td>42</td>
</tr>
<tr>
<td>7</td>
<td>48</td>
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<td>6</td>
<td>58</td>
</tr>
<tr>
<td>5</td>
<td>71</td>
</tr>
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<td>4</td>
<td>83</td>
</tr>
<tr>
<td>3</td>
<td>93</td>
</tr>
<tr>
<td>2</td>
<td>98</td>
</tr>
<tr>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4: Yield Reduction Due to Soil Sodicity

<table>
<thead>
<tr>
<th>ESP %</th>
<th>Relative crop yield %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rice</td>
</tr>
<tr>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>≤15</td>
<td>100</td>
</tr>
<tr>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>&gt;35</td>
<td>50</td>
</tr>
</tbody>
</table>
Current Land Use and Crop Intensity

To obtain the land use pattern over the area, IRS LISS III data of 2013-14 are used for three seasons Rabi, Kharif and Zaid. The area is covered by three scenes of IRS LISS III (100-53, 101-53 and 102-53). To identify various land use land cover classes a supervised classification approach has been adopted and various land cover classes are identified and validated with frequent field checks, Google Earth satellite data and other support data like CARTOSAT data (Figure 9). An accuracy assessment has also carried out to find out the agreement of classified data with ground truth or training sets.
As expected, Remote Sensing analyses also demonstrate the similar overview of irrigated agriculture in the canal command (Zhang and Xu, 2014, Enaruvbe and Atedhor, 2015). RS analyses clearly suggest that cropping intensity is lesser especially along branch and distributary canals in head and middle reaches.

Figure 10 and Figure 11 present the cropping intensity during Rabi and Kharif seasons. In both cases, intensity is comparatively low along head reaches of canals. A clear pattern of diminished cropping intensity is visible in both cases. However, low cropping intensity in canal tail reaches during Kharif is due to unreliable canal supply. In contrast, higher intensity in the tails during Rabi is due to use of groundwater to irrigate wheat which is not affordable in case of rice crop. A very low intensity exists in Zaid (Figure 12). This clearly shows that there is scope for crop intensification and diversification to justify the higher cost of groundwater use if conjunctive irrigation management strategy is adopted to address issues of water logging and consequent soil salinity and sodicity.
Figure 7 Rabi cropping intensity in JBS pilot study area

Figure 8 Kharif cropping intensity in JBS pilot study area
V. CONCLUSIONS

- Irrigated agriculture in canal command is threatened by waterlogging and subsequent salinity and sodicity, leading to comparatively low cropping intensity and productivity.
- Conjunctive irrigation management appears to be a realistic option to address the issue. Low Zaid intensity offers the scope of crop intensification and diversification to justify the higher cost of conjunctive irrigation due to increased use of groundwater.
- If conjunctive irrigation management is practiced at head and middle reaches, more canal supply will be available for tail reaches. This will also improve the equitability and reliability of water distribution in the JBS system.
- GIS and RS tools prove to be quite handy to analyze various scenarios of integrated water resources management.
REFERENCES


www.ijsrp.org
development and yield, analysis of salt tolerance according to several classification methods.
Agric Water Manage 62: 37–66

12. Mott, Hay and Anderson Consulting Engineers (1988): Shear rules for the assesment of
concrete bridge structures, Contractors Report Copy ID: 54046000280907, Library: SSR,
Location: SSR-SHELF, Mott Macdonald Consultants Limited

EFFECTS OF DROUGHT DYNAMICS ON VEGETATION COVER IN MARIGAT SUB-COUNTY, BARINGO COUNTY, KENYA

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Abstract- Drought is a norm rather than exception in Marigat Sub-County, Baringo County in Kenya where it adversely affects vegetation and water resources which are key resource for pastoralism. However, the effects vary depending on the dynamic of each drought event. This study sought to establish the drought dynamics in in Marigat Sub-County and how the dynamics affect vegetation cover in the County. A sample size of 368 households from a total study population of 9,160 households was selected for the survey alongside meteorological datasheets, remotely-sensed images, hydrological datasheets and maps. Droughts were frequent in Marigat Sub-County occurring once in every two years. The intensity the droughts ranged from 0.1 to 57.8 percent below the long-term mean. Whereas some droughts were on off events, majority occurred in runs with the longest lasting for up to 5 years (2000-2004). Vegetation cover was severely affected when droughts were prolonged and intense and vice versa. Bare grounds devoid of vegetation cover were common during prolonged and intense droughts as it was experienced during the 2000 La Nina drought (NDVI value of 0.07). As the inhabitantsstrived to cope with the effects of droughts, they turned into their immediate environment exploiting the available resources. This led to destruction of vegetation cover through activities such as overgrazing on wetlands and forested areas, charcoal burning and clearing of vegetation to allow crop farming. Thus with the increasing drought frequency, duration and intensity, if the environmental degradation remains unchecked Marigat Sub-County will become a desert devoid of vegetation.

Index Terms- Droughts, Drought Frequency, Drought Duration, Drought Intensity, NDVI, Vegetation cover

I. INTRODUCTION

Drought is a natural phenomenon that exists when precipitation is significantly below 500-650mm affecting land resource production systems (UNEP, 1998; Ngaira, 2005). They occur in all climates but more predominant in the drylands. However, droughts vary in their mode of occurrence in terms of duration, intensity and frequency affecting land cover at varied magnitudes (http://www.isws.illinois.edu/hilites/drought, 2011). In Australia for instance, the 1958 lasted for 10 years ending in 1968 (Lake, 2011) while in the southern and eastern parts of Australia a 12-year drought ravaged the country between 1996 and 2008 (Kogan et al., 2012). The frequency and intensity of droughts are increasing in a number of regions in the world (Owramigur, et al., 2011). However, the intensity vary from one drought to the other with some occurring rapidly but short lived while others develop slowly but persist for a long time (Smith, 2011). In Russia the 2010 drought was severe not only covering vast areas but also led to serious damages to the environment (Kogan et al., 2012).

Droughts trigger major changes in vegetation cover and their adverse impacts depend on their intensity, duration, frequency and severity. Eldridge et al (2011) observed that vegetation composition in the arid and semi-arid grasslands and savannahs of the world has changed. Droughts are among the major contributors of these changes (Parolin, 2010). According to Owen (2008) a 15-month drought between 2002 and 2003 across Arizona and New Mexico led to loss of Ponderosa pine and Pinon-juniper ecosystem with over 90 percent of Pinon trees being lost. Godfree et al (2011) observed that the 2006-2007 extreme drought in Southeastern Australia led to destruction of temperate grasslands resulting in decline of grassland species. Africa, like other continents, has been experiencing droughts of varied characteristics with diverse effects on vegetation cover. Between 1970 and 2006 droughts accounted for 20% of the natural disasters affecting over 80% of the entire African population (Huho and Mugalavai, 2010). According to Murungaru (2003) the severity and frequency of droughts in Kenya, for instance, seems to be increasing over time. In the ASALs of northern Kenya, the frequency has increased from once in every 10 years in the 1970s; once in every 5 years in the 1980s; once in every 2 to 3 years in the 1990’s and now annually since the year 2000 (Howden, 2009). Massive loss of vegetation cover have been experienced during the 1979-80 and 1991-2011 severe droughts in Turkana District (Terrence, 2010; Huho and Ngaira, 2011), the 2003-2006 and the 2008-2009 droughts in Laikipia County (http:// www.acted.org/en/kenya, 2013, Terrence, 2010).
II. OBJECTIVES OF THE STUDY

The study was guided by the following objectives:
1) To establish drought dynamics in Marigat Sub-County
2) To examine the effects of drought frequency, intensity and duration on vegetation cover in Marigat Sub-County

III. STUDY AREA AND METHODOLOGY

Data for the study was collected from Marigat Sub-County which covers an area of 1,346 square kilometers and has a population of 41,780 persons comprising of 20,826 males and 20,954 females in 9,160 households. A total number of 368 households were interviewed. The population density is 53 persons per square kilometer. The sub-county is divided into 11 locations (Figure 1). Rainfall is about 50 percent reliable while the variability is very high. The annual mean minimum and maximum temperatures range from 16 to 18 °C and 25 to 30 °C respectively. Data was largely collected through the use of questionnaires, interviews and observation. Rainfall data obtained from Kenya Agricultural Research Institute (KARI) - Perkerra Meteorological Station was used to analyze drought years as well as drought duration and intensity. The remotely sensed data was analyzed using ERDAS IMAGINE Version 2011 and ArcMap Version 10.1 softwares and was used to monitor the vegetation cover. Normalized drought vegetation index (NDVI) was used to indicate the level of vegetation greenness or availability of pasture.

IV. RESULTS AND DISCUSSION

A. Drought Characteristics
Drought dynamics were assessed based on the following drought characteristics: occurrence and frequency, duration and intensity.

Drought Occurrence and Frequency
The study used 33 years annual rainfall data for a period between 1980 and 2012 to depict droughts years. Years with annual amount of rainfall below calculated long term mean of 563.7mm for the period under study were considered as drought years. As a result, Marigat Sub-County recorded 18 droughts which occurred in 1980, 1984, 1986, 1992, 1994, 1995, 1996, 2000, 2001, 2002, 2003, 2004, 2006, 2008, 2009, 2010, 2011 and 2012 (Table 1). Analysis of rainfall data in Table 1 revealed an increase in droughts frequency of occurrence. During the 1980-1989 decade, 3 out of 10 years (30%) were drought years. The frequency rose to 4 in every 10 years (40%) in the 1990s and 8 out of 10 years (80%) in 2000s. The 1980s droughts occurred in 1980, 1984 and 1986, the 1990s droughts occurred in 1992, 1994, 1995 and 1996 while in the 2000s drought occurred in all years except 2005 and 2007. The observation was in agreement with Howden (2009) who notes that the frequency of droughts in northern Kenya have now become an
annual phenomenon in the 2000s. The frequency was once in every 10 years in 1970s, once in every 5 years in 1980s, once in every 2-3 years in 1990s. Similar increasing drought frequency has been observed in most dry lands of the world. In eastern parts of Ethiopia for instance, droughts occurred once in every 2 years in the 1990s and almost on an annual basis in 2000s (Mekuria, 2012).

**Table 1:** Drought and Non-drought years in Marigat Sub-County (1980 – 2012) (Source: KARI Perkerra Meteorological Station, 2014)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total annual amount of rainfall (mm)</th>
<th>Drought/Non drought event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>427.5</td>
<td>Drought</td>
</tr>
<tr>
<td>1981</td>
<td>692.1</td>
<td>Non drought</td>
</tr>
<tr>
<td>1982</td>
<td>666.7</td>
<td>Non drought</td>
</tr>
<tr>
<td>1983</td>
<td>703.3</td>
<td>Non drought</td>
</tr>
<tr>
<td>1984</td>
<td>270.5</td>
<td>Drought</td>
</tr>
<tr>
<td>1985</td>
<td>714.4</td>
<td>Non drought</td>
</tr>
<tr>
<td>1986</td>
<td>510.6</td>
<td>Drought</td>
</tr>
<tr>
<td>1987</td>
<td>587.0</td>
<td>Non drought</td>
</tr>
<tr>
<td>1988</td>
<td>892.9</td>
<td>Non drought</td>
</tr>
<tr>
<td>1989</td>
<td>842.0</td>
<td>Non drought</td>
</tr>
<tr>
<td>1990</td>
<td>590.5</td>
<td>Non drought</td>
</tr>
<tr>
<td>1991</td>
<td>667.5</td>
<td>Non drought</td>
</tr>
<tr>
<td>1992</td>
<td>562.0</td>
<td>Drought</td>
</tr>
<tr>
<td>1993</td>
<td>654.9</td>
<td>Non drought</td>
</tr>
<tr>
<td>1994</td>
<td>563.4</td>
<td>Drought</td>
</tr>
<tr>
<td>1995</td>
<td>500.1</td>
<td>Drought</td>
</tr>
<tr>
<td>1996</td>
<td>539.7</td>
<td>Drought</td>
</tr>
<tr>
<td>1997</td>
<td>780.8</td>
<td>Non drought</td>
</tr>
<tr>
<td>1998</td>
<td>760.4</td>
<td>Non drought</td>
</tr>
<tr>
<td>1999</td>
<td>637.6</td>
<td>Non drought</td>
</tr>
<tr>
<td>2000</td>
<td>256.9</td>
<td>Drought</td>
</tr>
<tr>
<td>2001</td>
<td>411.2</td>
<td>Drought</td>
</tr>
<tr>
<td>2002</td>
<td>237.6</td>
<td>Drought</td>
</tr>
<tr>
<td>2003</td>
<td>275.4</td>
<td>Drought</td>
</tr>
<tr>
<td>2004</td>
<td>275.8</td>
<td>Drought</td>
</tr>
<tr>
<td>2005</td>
<td>626.6</td>
<td>Non drought</td>
</tr>
<tr>
<td>2006</td>
<td>529.3</td>
<td>Drought</td>
</tr>
<tr>
<td>2007</td>
<td>926.8</td>
<td>Non drought</td>
</tr>
<tr>
<td>2008</td>
<td>452.4</td>
<td>Drought</td>
</tr>
<tr>
<td>2009</td>
<td>486.3</td>
<td>Drought</td>
</tr>
<tr>
<td>2010</td>
<td>550.7</td>
<td>Drought</td>
</tr>
<tr>
<td>2011</td>
<td>510.2</td>
<td>Drought</td>
</tr>
<tr>
<td>2012</td>
<td>496.1</td>
<td>Drought</td>
</tr>
</tbody>
</table>

Mean=563.7 mm

**Drought Duration**

Drought varied in duration from one drought event to the other. The drought durations ranged from 1 to 5 years over the period under study. Like the drought frequency, the duration has been increasing. In 1980s droughts occurred as one-off events. In 1990s the drought duration ranged from 1 to 3 years and up to 5 years in 2000s. A 3-year drought was experienced between 1994 and 1996 in the 1990s while a 5-year drought occurred between 2000 and 2004 in the 2000 decade (Table 2).
Table 2: Decadal drought duration (Source: Analyzed KARI - Perkerra Meteorological Station data, 2014)

<table>
<thead>
<tr>
<th>Decade</th>
<th>Drought Year</th>
<th>Total annual amount of rainfall (mm)</th>
<th>Drought</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>1980</td>
<td>427.5</td>
<td>Drought</td>
</tr>
<tr>
<td></td>
<td>1984</td>
<td>270.5</td>
<td>Drought</td>
</tr>
<tr>
<td></td>
<td>1986</td>
<td>510.6</td>
<td>Drought</td>
</tr>
<tr>
<td>1990</td>
<td>1992</td>
<td>562.0</td>
<td>Drought</td>
</tr>
<tr>
<td></td>
<td>1994</td>
<td>563.4</td>
<td>Drought</td>
</tr>
<tr>
<td></td>
<td>1995</td>
<td>500.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1996</td>
<td>539.7</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>2000</td>
<td>256.9</td>
<td>Drought</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>411.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>237.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>275.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>275.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>529.3</td>
<td>Drought</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>452.4</td>
<td>Drought</td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>486.3</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>2010</td>
<td>550.7</td>
<td>Drought</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>510.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>496.1</td>
<td></td>
</tr>
</tbody>
</table>

Long term mean rainfall from 1980-2012 = 563.7mm

Drought Intensity

Drought intensity was calculated using the following formula and the results indicated in Table 3

\[
DI = \frac{X - \bar{X}}{\bar{X}} \times 100\%
\]

The negative sign for the calculated drought intensity indicates the percentage of total annual rainfall for a specific year below the calculated long term mean rainfall (Trotman et al, 2007).
Table 3: Drought intensity for the identified drought years (1980-2012) (Source: Analyzed KARI - Perkerra Meteorological Station data, 2014)

<table>
<thead>
<tr>
<th>Drought Year</th>
<th>Total Annual amount of rainfall (mm)</th>
<th>Drought intensity (%)</th>
<th>% below the long term mean rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>427.5</td>
<td>-24.2</td>
<td>24.2</td>
</tr>
<tr>
<td>1984</td>
<td>270.5</td>
<td>-52.0</td>
<td>52.0</td>
</tr>
<tr>
<td>1986</td>
<td>510.6</td>
<td>-9.4</td>
<td>9.4</td>
</tr>
<tr>
<td>1992</td>
<td>562.0</td>
<td>-0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>1994</td>
<td>563.4</td>
<td>-0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>1995</td>
<td>500.1</td>
<td>-11.3</td>
<td>11.3</td>
</tr>
<tr>
<td>1996</td>
<td>539.7</td>
<td>-4.3</td>
<td>4.3</td>
</tr>
<tr>
<td>2000</td>
<td>256.9</td>
<td>-54.4</td>
<td>54.4</td>
</tr>
<tr>
<td>2001</td>
<td>411.2</td>
<td>-27.1</td>
<td>27.1</td>
</tr>
<tr>
<td>2002</td>
<td>237.6</td>
<td>-57.8</td>
<td>57.8</td>
</tr>
<tr>
<td>2003</td>
<td>275.4</td>
<td>-51.1</td>
<td>51.1</td>
</tr>
<tr>
<td>2004</td>
<td>275.8</td>
<td>-51.1</td>
<td>51.1</td>
</tr>
<tr>
<td>2006</td>
<td>529.3</td>
<td>-6.1</td>
<td>6.1</td>
</tr>
<tr>
<td>2008</td>
<td>452.4</td>
<td>-19.7</td>
<td>19.7</td>
</tr>
<tr>
<td>2009</td>
<td>486.3</td>
<td>-13.7</td>
<td>13.7</td>
</tr>
<tr>
<td>2010</td>
<td>550.7</td>
<td>-2.3</td>
<td>2.3</td>
</tr>
<tr>
<td>2011</td>
<td>510.2</td>
<td>-9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>2012</td>
<td>496.1</td>
<td>-12.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Long term mean rainfall from 1980-2012 = 563.7mm

Table 3 revealed that drought intensity in Marigat Sub-County ranged from 0.1 to 57.8 percent below the long term mean. This implies that droughts occurring in the same area vary in terms intensity. The greater the negative variations from the long term mean, the higher the drought intensity. In this case, the 1994 drought where annual rainfall was 0.1 percent below the long term mean was of lesser intensity compared to the 2002 drought where annual rainfall was 57.8 percent below the long term mean. Actually, the 2002 drought was the most intense drought in the study area for the period under the study. The 2002 drought was wide spread affecting others parts of the world. For instance, San Diego in California recorded 51.1 percent rainfall below the long term mean whereas Quad cities in the US recorded 59 percent rainfall below the long term mean in the year 2002 (Pidwirny, 2008). In Ethiopia, North Afar zones, the 2002 drought was considered the worst and intense in human memory even worse than 1984-1985 droughts due to combination of high loss of animals and yields (Mekuria, 2012).

### B. Effects of Drought Dynamics on Vegetation Cover

Droughts triggered major changes on vegetation cover in the study area. The magnitude of the vegetation cover change depended on the dynamic of the drought as explained below.

**Diminishing of Grasslands Pastures and Shrubs Cover**

Different types of rangeland vegetation were affected differently by droughts of varying characteristics. Respondents reported that grasslands pastures (annual grasses) and shrubs had diminished in the study area. This was attributed to the sensitive nature of annual grasses and shrubs to varying drought characteristics compared to tree cover and wetland vegetation. Mwangi and Swallow (2005) asserts that the predominant annual grasses and shrubs of the 1980 and 1990 decades in Kimalel, Kimondis, Elwalel-Soi, Salabani, parts of Kapkuikui and Marigat Locations had declined tremendously. Overall, vast lands of the study area laid bare (devoid of vegetation) over the study period. This was attributed to the increasing drought frequency, duration and intensity. The severe and prolonged droughts that were experienced during the 2000-2009 decade led to increase in bare grounds in most rocky areas of Kimalel, Salabani, Kimondis and Elwalel-Soi Locations. This was triggered by drying up of vegetation following the 5-year drought that occurred from 2000 – 2004, and the 2-year drought that occurred from 2008 to 2009. The observations made by the respondents was supported by the analyzed NDVI data from Landsat satellite images (Table 4 and Figure 2) on the effects of droughts of varying characteristics on riverine vegetation along Lake Baringo shores. From the satellite images the areas with green color represents the vegetation.
Table 4: NDVI values and drought intensity (Source: Analyzed Meteorological Data, 2014 and http://glovis.usgs.gov)

<table>
<thead>
<tr>
<th>Drought year</th>
<th>Mean NDVI values</th>
<th>Drought intensity (%) below long term mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>0.03</td>
<td>52.0</td>
</tr>
<tr>
<td>1994</td>
<td>0.08</td>
<td>0.1</td>
</tr>
<tr>
<td>2000</td>
<td>-0.07</td>
<td>54.4</td>
</tr>
</tbody>
</table>

Table 4 and Figure 2 revealed that droughts of different intensities can drive significant changes in plant biomass in an area. When the drought intensity is low e.g. 0.1 for 1994, the mean NDVI value is high (0.08 for 1994). In such drought event, the study area had most of the area covered with sparse vegetation (as indicated by the brown colour) and relatively higher concentration of shrubs and grassland vegetation (as indicated by the green colour) than when droughts are severe. When the intensity is higher, the NDVI value is low as it was during the 1984 and 2000 droughts. Vast areas were characterized by bare soils and rocks (indicated by diminishing green and brown colours and increase in yellow colour). The relationship between drought intensity and mean NDVI values could be explained by the fact that droughts with high intensity reduce the plant biomass, which has a high NDVI value, leaving bare soils and rocks with low NDVI values. The observation was in line with Travis (2006) findings in San Antonio region, Texas, who observed changes in NDVI images of 1999 and 2002. The mean NDVI values were noted to change from 0.195 in 1999, the year which recorded a drought of high intensity to 0.361 in 2002, the year with low drought intensity. The findings were also in line with Auken (2000) assertion that prolonged droughts experienced in the semi-arid of North America between 1987 and 1999 led to 54 percent decline of grasslands and 32 percent decline of shrub lands in the region respectively.
Reduction in Tree Cover
Reduction in tree cover was one of the most noted changes in vegetation cover. The most affected was the Acacia tree species, especially in the lowland parts of the sub-county which comprised of Marigat, Il-Chamus, Iling’arua and Ngambo Locations. Decline in tree cover was attributed to the extensive use of Acacia tree for charcoal burning as a coping strategy against droughts. The increasing number of charcoal bags (25-30 kg standard bag) sold form the sub-county indicated the high rates of tree felling (Figure 3). In addition the in migration by pastoralists from outside the sub-county during prolonged and severe droughts led to overgrazing in forested area (Table 5) resulting in destruction of trees. Grazing took place in Kaptich and Lpunyaki Forests in Marigat and Nga’mbo Locations respectively.

Table 5: Frequency of grazing in dry-season grazing fields in the study area (Source: Field Data, 2014)

<table>
<thead>
<tr>
<th>Where livestock grazed during dry season</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forests</td>
<td>46</td>
<td>13</td>
</tr>
<tr>
<td>Swamps</td>
<td>119</td>
<td>32</td>
</tr>
<tr>
<td>Along the riverine areas</td>
<td>106</td>
<td>29</td>
</tr>
<tr>
<td>Migrating to other areas</td>
<td>97</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>368</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 3: Increasing trend in number of charcoal bags produced in the study area (Source: field data, 2014)

Increase in charcoal production was attributed to the high number of inhabitants who engage in charcoal burning during drought periods. Savatia (2009) observes that over 70 percent of the pastoralists in the semi-arid areas of Northwestern Kenya engaged in charcoal burning and selling during the 2008 drought.

Destruction of Riparian Vegetation
The riparian (wetland and riverine) vegetation along Perkerra and Molo Rivers and wetland areas in Loboi and Marigat Locations were reported to have drastically reduced since the year 2000. The wetlands included Arabel and Perkerra Scheme in Marigat Location, Loboi Swamp in Loboi Location and Lake Baringo shores. The prolonged and intense droughts of the 2000 decade led to conversion of the wetland to farmland for agricultural purposes. About 80 percent of the respondents revealed that there was overgrazing on the wetland during the droughts. Table 4 indicates that 61 percent of the respondents grazed in the wetlands during prolonged and severe droughts and hence the rate of overgrazing increased with increasing drought intensity and duration. The analyzed NDVI data from Landsat satellite images revealed changes on riparian vegetation with varying drought characteristics as shown in Figure 4.
The NDVI data showed variations in amount of plant biomass during droughts of different intensities and durations. Droughts of high intensity resulted in low NDVI values compared to droughts of low intensity as shown in Table 5 and Figure 4. Depletion of wetland vegetation led to reduction in plant biomass. The study established that the low intensity drought of 1994 recorded a relatively higher amount of wetland vegetation (indicated by red colour) compared to the high intensity droughts of 1984 and 2000. The relatively similar amount of wetland vegetation cover during the 1984 and 2000 droughts can be explained by comparable drought intensities. The findings support other studies which indicate that depletion of riparian vegetation vary from year to year depending on drought characteristics (see Jacob, 2011; Urama & Ozor, 2010).

**Figure 4:** Riparian vegetation along Lake Baringo shores during droughts of varying intensities (Source: http://glovis.usgs.gov/, Downloaded on: 21/11/ 2014)
**Change in Land Use Activity**

Changes in land use had directly and indirectly affected vegetation cover. Land use had changed from predominantly pastoralism in the 1980s to agro-pastoralism in 2000s (Figure 5).

![Image of land use type percentages over decades](image)

**Figure 5:** Changes in land use over the decades (Source: Field Data, 2014)

In 1980s, pastoralism predominated accounting for 98 percent of the household livelihood source. Only two percent of the households practiced agro-pastoralism. Household practicing pure crop farming emerged in 1990s accounting for 2 percent. In 2000s, agro-pastoralism predominated accounting for 57 percent of the households. Pastoralism and pure crop farming accounted for 38 and 5 percent respectively in 2000s. Currently about 65 percent of the households practice agro-pastoralism and about 10 percent practice pure crop farming. Pastoralism has been declining over the decades. This could be in response to the growing population and climate change i.e. increasing drought occurrences in the sub-county. The need for agricultural land has led to massive destruction of wetland vegetation and forest cover. As drought frequency, intensity and duration increases, the need for expansive land for cultivation increases. This acts a coping strategy where farmers maximize crop production by increasing the acreage under cultivation. These findings are consistent with those of Abdi et al., (2012) who also reported that population pressure and recurrent drought occurrences are the main driving forces of change in land use activity in the Semi-Arid of East Kordafan of Western Sudan. Studies by Kioko and Okello (2010) also associated climate change and population increase to the drastic changes in land use activity in the semi-arid rangeland of Southern Kenya.

V. CONCLUSIONS

Evidence indicates that droughts in Marigat Sub-County were becoming more frequent, prolonged and intense over the years. However, drought characteristics varied from one drought event to the other. Whereas all droughts affected vegetation cover, the magnitude of influence varied depending on drought dynamics. Frequent, prolonged and high intensity droughts had severe effect on vegetation cover compared to short-term and low intensity droughts. Droughts also caused changes in land use which directly or indirectly led to destruction of vegetation cover as people sought of agricultural land. With the increasing drought frequency and severity, if the environmental degradation remains unchecked Baringo County will become a desert devoid of vegetation.

REFERENCES


EVALUATION OF OXIDATIVE STRESS MARKER AND REDOX ENZYME IN PRIMARY OPEN ANGLE GLAUCOMA

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Email:masitha_ds@yahoo.co.id

ABSTRACT

Objective: To identify the presence of oxidative stress marker malondialdehyde (MDA) and redox enzyme glutathion peroxidase (GPx) in primary open angle glaucoma (POAG) and relationship between oxidative stress marker malondialdehyde (MDA) and redox enzyme glutathion peroxidase (GPx) with primary open angle glaucoma

Methods: A prospective, analytical observational with cross sectional study was conducted at the Adam Malik Hospital from January 2015 to Mei 2015 after approved by the Ethics Committee for Health Research Sumatera Utara University School of Medicine. Twenty eightpatients primary open angle glaucoma and twenty eight healthy controls patients of match age andgender were included in this study prospectively.

Results: The concentration of MDA was significantly higher (p=0.015*) and the concentration of GPx was significantly lower (p=0.034*) in POAG group compared to control group.

Conclusions: Oxidative stress and redox enzyme is an important risk factor in the development of primary open angle glaucoma (POAG). Increased levels of oxidative stress products may be associated with primary open angle glaucoma. Therefore, assessment of oxidative stress marker and redox enzyme in POAG may be important for the therapy and prevention of glaucoma.

Keywords: malondialdehyde (MDA), glutathion peroxidase, primary open angle glaucoma

INTRODUCTION

Glaucoma refers to a group of diseases that have common a characteristic progressive optic neuropathy with associated with visual function loss and higher of intraocular pressure as a risk factor [1].

Glaucoma usually called “ the silent thief of sight” because the onset usually suddenly without symptom beforely. Glaucoma can caused irreversible blindness worldwide, including in Indonesia [2].

The pathogenesis of glaucoma is multifactorial and until now still investigate.Retinal ganglion cell (RGC) death due to apoptosis and loss of RGC axons leads to glaucomatous optic neuropathy. Many factors play role in pathogenesis glaucoma included genetic, glutamate excitotoxicity, nitric oxide and oxidative stress [3]. Oxidative stress appears play a role in progressive neuronal death that is characteristic of glaucomatous optic nerve damage [3,4]. Oxidative stress generally is induced through formation of multiple reactive oxygen species including hydrogen peroxide and superoxide that can initiate and propagate free radicals. The oxidative burden between prooxidant and antioxidant is oxidative stress that damages cellular and tissue macromolecules such as lipids, proteins and results in cellular and tissue dysfunction and cellular death [5].

Many biologic substances growth as an oxidative stress marker such as malondialdehyde (MDA), catalase and sodium dismutase [6]. Increased marker of oxidative stress that have been reported in glaucoma included oxidized DNA bases, lipid oxidation products and total oxidative stress marker. A number of studies in vitro and in vivo suggested that there was a role of oxidative stress marker in
glaucoma patient[5,7]. Haefiger et al reported destroyed oxidized DNA in trabecular meshwork change of matrix extracellular regulate and cytokine in glaucoma patients[7]. Flammer reported the destroyed of DNA in trabecular meshwork was higher in glaucoma patients compared to normal subjects[8].

The relationship between oxidative stress marker with glaucoma has already been reported. Flammer reported the concentration of oxidative nucleotide modification (8-OH-dG) in trabecular meshwork with glaucoma patients were correlated with the higher of intraocular pressure and decreased of visual field. Faschinger et al reported there was a positive correlation between malondialdehyde (MDA) in aqueous humor glaucoma patients compared to normal subjects[7,8,9].

From these studies, the aim of the current study was to evaluate stress oxidative marker malondialdehyde (MDA)) and redox enzyme gluthathion peroxidase (GPx) in primary open angle glaucoma (POAG) and investigate the relationship between oxidative stress marker and POAG

MATERIALS AND METHODS

Subjects

This was a prospective, cross sectional study comprising twenty eight patients with primary open angle glaucoma and twenty eight control subjects as the same age range and sex were included in this study. These subjects were recruited consecutively at Haji Adam Malik Hospital North Sumatera, Indonesia. Ethical approval was obtained from University Sumatera Utara Ethics Committee. A written consent was obtained from all patients by the researchers.

All subjects underwent ophthalmologic examination included measured of best corrected visual acuity (BCVA), intraocular pressure by Goldman applanation tonometry and slitlamp examination, gonioscopic (Carl Zeiss Meditec AG, Jenna, Germany), visual field with Octopus 301 and reliable SAP, optic disc with direct funduscopy (Neitz, Japan).

Inclusion criteria: We included patients and healthy subjects who fulfilled the following criteria: age older > 40 years old, POAG patients was diagnosed based on presence of an open iridocorneal angle, the characteristic appearance of glaucomatous optic neuropathy such as enlargement of optic cup disc ratio, focal thinning of neuroretinal rim and corresponding visual field defects with Octopus 301 (Haag-Streit, Interzeag International AG, Schlieren, Switzerland) and elevated intraocular pressure.

Exclusion criteria: The exception criteria included patient with cataract, ocular infection, retinopathy, taking medication as steroid and had systemic diseases such as diabetes mellitus and hypertension.

Blood Sampling

Venous blood specimens were collected from the antecubital vein into evacuated tubes 5 cc. Plasma samples obtained by centrifugation 3500 rpm. The collected venous blood were stored at 4°C, supernatants keep in -20°C and determination of the samples occurred within 3 months.

Laboratory Analysis

Malondialdehyde Assay

The activity of malondialdehyde (MDA) was determined by using OXIS MDA (Biotxytech). MDA was measured as thiobarbituric acid reacting substance (TBARS) production in the following manner. 0.1 ml of sample was added to a 1:1:1 (Vol/vol/vol) solution of trichloroacetic acid (15%,wt/vol), thiobarbituric acid (0.375%,wt/vol), and hydrochloric acid (0.25M). The mixture was heated at 100°C for 30 min. The mixture was immediately cooled and then centrifuged (3500 g for 5 min) to remove undissolved materials. Then the absorbance at 586 nm was determined. The amount of TBARS was calculated from comparison with authentic malondialdehyde[10,11].

Gluthathione Peroxidase Assay

The activity of GPx was determined according to the method by Paglia and Valentine using RANSEL kit. GPx was determined spectrophotometrically by coupling the oxidation of gluthathione and NADPH
using GR. Briefly, 1 ml of assay mixture contains optimized concentrations of the following chemicals: 0.5M K2HPO4 (pH 7.0), 2.5mM EDTA, 0.18U/ml GR, 100 mMglutathione and 10 mM reduced NADPH and tissue extract 0.5mL was added in the spectrophotometer cuvette along with 0.1mL cumenehydroperoxide, a suitable substrate for GP. The mixture was placed into a 1 mL cuvette and read with Shimadzu UVPC 2100 spectrophotometer set at 340 nm at 37°C. All chemicals were from Randox Laboratory Ltd[12].

Statistical Analysis

The collected data write in the research publication and keep in the computer. The collected data kept in computer analysed by using the statical software. To compare quantitative variables between the two groups, unpaired t-test was used. Statistical analyses were performed with SPSS 19.0 and the level significance was P< 0.05 in all statistical test.

RESULTS

The study was conducted from January 2015 to May 2015 in 28 primary open angle glaucoma patients and 28 healthy patients

Table 1. The demographic parameters from 28 primary open angle glaucoma patients and 28 healthy control

<table>
<thead>
<tr>
<th></th>
<th>Primary open angle glaucoma group</th>
<th>Control group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>28</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>55.42 ±5.31</td>
<td>54.92±4.24</td>
<td>0.859</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>14/14</td>
<td>15/13</td>
<td></td>
</tr>
<tr>
<td>IOP right eye (mmHg)</td>
<td>22.64 ±8.79</td>
<td>15.87±2.41</td>
<td>0.001**</td>
</tr>
<tr>
<td>IOP left eye (mmHg)</td>
<td>22.37 ± 5.52</td>
<td>14.21±2.53</td>
<td>0.001**</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>122.83± 5.64</td>
<td>123.70± 6.31</td>
<td>0.902</td>
</tr>
<tr>
<td>Diastolic blood</td>
<td>80.25±4.91</td>
<td>82.6± 5.46</td>
<td>0.785</td>
</tr>
</tbody>
</table>

Based on the above table appear significant difference between IOP right eye and IOP left eye in primary open angle glaucoma patients (p<0.05) compared to control groups

Table 2. MDA levels in primary open angle glaucoma group compared with control group

<table>
<thead>
<tr>
<th></th>
<th>MDA (nmol/L)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>POAG group</td>
<td>3.51 ± 0.79</td>
<td>0.015*</td>
</tr>
<tr>
<td>Control group</td>
<td>2.84 ± 0.58</td>
<td></td>
</tr>
</tbody>
</table>

MDA : malondialdehyde

From the table 2, MDA significantly increased in POAG patients compared with control groups (p<0.05)

Table 3. GPx level in primary open angle glaucoma group compared with control group

<table>
<thead>
<tr>
<th></th>
<th>GPx(U/gHb)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>POAG patients</td>
<td>24.52 ± 6.13</td>
<td>0.034*</td>
</tr>
<tr>
<td>Control patients</td>
<td>30.95±4.35</td>
<td></td>
</tr>
</tbody>
</table>

GPx : Glutathione Peroxidase

From the table 3, GPx significantly lower in POAG patients compared with control groups (p<0.05)

DISCUSSION

Glaucoma is the second leading caused blindness after cataract in the world. Glaucoma refers to a group of diseases with optic neuropathy and decreased of visual field and higher intraocular pressure as a risk factor. Glaucoma can developed after as early as birth until older age, but the most in older people. The recent study reported 61 million people had primary glaucoma and 8.4 million people result bilateral blindness[9]. In general, glaucoma classified into three major: open angle glaucoma,
closed angle glaucoma and ongenital glaucoma. Open angle glaucoma is the most type of glaucoma[10].

The pathogenesis of glaucoma is multifactorial and until now still investigate. From some literature reported glaucoma not only caused destroyed of retinal ganglion cell and its axon, but involvement optic nerve head and retina which caused blood supply decreased[13,14]. From some study also reported involvement free radical is one of pathogenesis of glaucoma, so reactive oxygen species play a role of pathogenesis of glaucoma. In ophthalmology, oxidative stress has been reported to induced the progression of cataract and diabetic retinopathy. In glaucoma, antioxidant levels decrease in aqueous humor compared with normal subject. It’s suggested that peroxidation involved in development of glaucoma[15].

Recent datas indicate that oxidative stress plays an important role of pathogenesis of glaucoma, but until now the mechanism is unclear. The possible caused of increased oxidative stress might be include increased of free radical or impaired antioxidant defense system. Free radical can reacts with macromolecules as membrane lipid, protein, DNA which can changed the structure, functional and neuronal death endly[16,17]. From one study reported that there was increased of lipid peroxidation concentrate in aqueous humor, trabecular meshwork and canalissclemmi primary open angle glaucoma patients compared to controls dan the study reported lipid peroxidation caused destruction of trabecular meshwork and canalissclemmi. From one study animal trial with higher intraocular pressure reported that there was an increased of MDA levels in vitreous humor[18]. MDA is a decomposition product of peroxidized polyunsaturated fatty acids.

Based on result examination, we found that MDA plasma level was increased in primary open angle glaucomagroup compared with control group (Table 2) and GPx level was decreased in primary open angle glaucoma group compared with control group (Table 3). This result correlated with several studies have reported lower systemic levels of antioxidants in glaucoma, that is a reduced form of glutathione level was lower in red blood cells of glaucoma patients[13]. Faschinger et al reported there was a positive correlation between malondialdehyde (MDA) in aqueous humor glaucoma patients compared to normal subjects. The systemic antioxidant capacity could reflect the local ocular redox status. In experimental studies, free radical scavengers effectively prevented glaucomatous tissue such as glutamate and IOP induced RGC death, tumor necrosis factor induced axonal injury[19]. Collectively decreased levels of systemic antioxidant capacity might be in the glaucomatous TM and neuronal damage as a result of local inadequate defense against oxidative stress[20,21].

Our study demonstrated that oxidative stress marker MDA and redox enzyme GPx available for assessing oxidative stress in POAG, but the limitation of this study the amount of this patients little, more longer times and assessing another oxidative stress marker in primary open angle glaucoma is needed.

CONCLUSION

The present study indicates that oxidative stress marker and redox enzyme play a role in pathogenesis of primary open angle glaucoma. Therefore, assessment of oxidative stress marker and redox enzyme in POAG may prove a valuable marker in the assessment and routine monitoring in primary open angle glaucoma. Well design, good quality prospective longitudinal trials on larger populations are therefore needed in primary open angle glaucoma and another types of glaucoma related for the therapy and prevention of glaucoma.

ACKNOWLEDGMENT

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CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interest.

REFERENCES


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Time series prediction of sea surface temperature in Indian ocean by superensembling of artificial neural network output

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Abstract: ANN have been used to access the predictability of the sea surface temperature in Indian ocean. Sea surface parameter is used to understand the exchange of momentum, heat, gases and moisture across air sea interface. Its knowledge is necessary to explain and predict important climate and weather processes including the summer monsoon. The objective of the study is to have time series prediction of the sea surface temperature in Indian ocean by superensembling ANN outputs. Forecasting of severe weather conditions are proposed to be carried out. The possibility of accurate weather prediction is still a distant dream for researchers. The sensitive dependence of the weather system on initial conditions does not render the system to be modeled by deterministic methods. Such systems are called chaotic systems. It may, nevertheless, be useful to have a system which may be able to predict if catastrophic events will occur even if the scientific understanding of the subject remains limited. Therefore the creation of a model with dynamical characteristics similar to the unknown model generating the time series produced by these systems could help in the prediction of such systems. Artificial Neural Network is one such system. It remains to find out the actual effect of neural network ensemble forecast on the basis of sensitivity to initial conditions of the ANN and also on the basis of topological organization as the case is with dynamical modeling. Such ensembling is called superensembling in the context of present work. It is not a priori obvious whether or not the concept of multimodel ensembling has a natural significance in statistical forecasting. Does superensembling of ANN models can be equated with multimodel ensemble? A variation of the present proposal has been very recently proposed and successfully implemented. The study aimed to do multimodel ensembling by ANN models. In the context of the above study it is interesting to observe the error patterns while doing the superensembling as proposed in the present study wherein topological ensembling has been proposed.

Keywords: Super ensemble neural networks, sea surface temperature, autocorrelation, multimodel ensemble

1. Introduction

Sea Surface Temperature is a measure of the energy due to the motion of molecules at the top layer of the ocean. Depending on the sensor, space borne measurements give us an unprecedented global measurement of sea surface temperatures every few days to a week. To be more precise, Sea surface temperature(SST) is the water temperature close to the ocean's surface. The exact meaning of surface varies according to the measurement method used, but it is between 1 millimeter (0.04 in) and 20 meters (70 ft) below the sea surface. There are a variety of techniques for measuring this parameter that can potentially yield different results because different things are actually being measured. SST predictions are sought after by the users of coastal communities dealing with fishing and sports. Like the air above it SST changes significantly overtime, although relatively less frequently due to a high specific heat. The changes in water temperature over a vertical are high at the sea surface due to large variations in the heat flux, radiation, and diurnal wind near the surface, and hence SST estimations involve considerable amount of uncertainty. There are a variety of techniques for measuring SST. These include the thermometers and

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thermistors mounted on drifting or moored buoys and remote sensing by satellites. In case of satellites the ocean radiation in certain wavelengths of an electromagnetic spectrum is sensed and related to SST. Microwave radiometry based on an imaging radiometer called the moderate resolution imaging spectroradiometer is also popularly used to record SST. A time series is a sequence of data points, measured typically at successive points in time spaced at uniform time intervals. Examples of time series are the daily closing value of the Dow Jones Industrial Average and the annual flow volume of the Nile River at Aswan. Time series analysis comprises methods for analyzing time series data in order to extract meaningful statistics and other characteristics of the data. Time series forecasting is the use of a model to predict future values based on previously observed values. While regression analysis is often employed in such a way as to test theories that the current values of one or more independent time series affect the current value of another time series, this type of analysis of time series is not called "time series analysis", which focuses on comparing values of a single time series or multiple dependent time series at different points in time.

It has been pointed out by Tripathi and others(2011) that the importance of SST to accurate weather forecasting of both severe events and daily weather has been increasingly recognized over the past several years. Also, it significantly affects the monsoon locally as well as globally. Recent studies indicate that the Indian ocean impacts climate around the globe, including the widespread drought from 1998-2002 in US, southern Europe, and the parts of Asia. The importance of Indian ocean to remote climate variability has renewed interest in the study of SST anomalies of the Indian ocean. A successful simulation of the SST anomalies variation of the Indian ocean can also contribute to the monsoon forecast of the Indian subcontinent.

Using area-average SST twelve different NN models were developed for the twelve months in a year. Typically the model to predict SST for the month of January was based on all past observations of January. On evaluating the performance of the networks the authors found that the models were able to predict the anomalies with a good accuracy and whenever the dependence of present anomalies on past anomalies was nonlinear the NN models worked better than the linear statistical models. Collins and others (2004) have used meteorological variables such as input to predict targeted satellite-derived SST values in the western Mediterranean Sea. The networks trained in this way predicted the seasonal as well as the interannual variability of SST well. The impact of the heat wave that occurred during the summer of 2003 on SST was also reproduced satisfactorily. Kuge and others (2004) have compared prediction skills of different methods based on certain transfer functions, regressions, and artificial neural network. The authors analyzed data of radiolarian faunal abundance from surface sediments observed at the Atlantic and Pacific oceans. The error statistics associated with the NN predictions were found to be more attractive than the other methods, although NN yielded lesser geographic trends than those of the other methods. Gradients of Sea Surface Temperature (SST) are important in determining the position of precipitation over the tropics including monsoon regions. It is assumed that the SST Anomaly (SSTA) over Indian Ocean vitally determines the monsoon rainfall variability.

It has been asserted by K.C Tripathi and others(2006) that Indian summer monsoon, which is a part of the Asian monsoon system, is a regular annual phenomenon which brings heavy rainfall to India and adjacent countries during summer monsoon season (June to September; JJAS). It contributes about 70% - 90% of rainfall in most parts of country whereas, the rainfall during October-November-December (OND) over south India which is commonly referred as winter monsoon rainfall. It contributes about 50% of annual rainfall in the east cost of Indian Peninsula. The winter monsoon is highly variable both spatially and temporally. During winter monsoon season the prevailing wind becomes north-easterly and the zone of maximum rainfall migrates to southern India.
A better understanding of the monsoon cycle is clearly of scientific and social value. Monsoon prediction studies have utilized indicators of atmospheric circulation, land surface conditions, and Indian and Pacific Oceans SSTs (summarized in Webster et al. 1998). The predictive relationship between Indian Ocean SST and monsoon rainfall remains especially poorly characterized, particularly at lead times greater than 1–2 months before the boreal summer monsoon season. Their study assesses the relationship between SST variations in the tropical Indian Ocean and Indian monsoon rainfall, including the temporal stability of these linkages over the past 50 yr with the goal of improving multivariate monsoon prediction efforts.

1.1 Artificial neural network and forecasting

Intelligent systems are so called because they are “adaptive”, in the manner in which we humans are. These systems differ from the “rigid” systems in the sense that the latter, by their inherent design, have poor or zero power of decision-making. As an example there is only one possible regression line through a data set. On the other hand, the intelligent systems “evolve” in time. They search for a better solution (but may not come up with the best solution every time) in the solution space. There may be many solutions to a problem. This, somehow, resemble the behavior of human systems that are capable of decision-making. It is mentioned in the thesis of K C Tripathi and others (2011) that with the success of the back propagation rule for finding the derivatives. ANN became a popular tool in artificial intelligence, robotics and several authors categorically stated the importance of artificial intelligence techniques for weather forecasting and peer reviews. Comparison of ANN and traditional techniques of forecasts had begun to attract the researchers. Lepedes and Farber (1987) were the first to report that simple neural networks can outperform traditional methods by several orders of magnitude.

1.2 Ensemble forecasting

Neural network ensemble is a learning technique where many neural networks are jointly used to solve a problem. Neural network ensemble helps in improving generalization and also removes the error related to initial conditions. The output of the neural network ensemble is considered to have high correlation and low root mean square error. Aggarwal and others (2013) defined Ensembles represent a natural extension of common neural network practice that undoubtedly owes its roots to earlier works using conventional forecasting tools. Generally to create such an ensemble, several networks are trained out of which best networks are chosen to create an ensemble. Construction of neural network ensemble involves two steps: training the individual networks and then combining their predictions. Individual networks can be trained using different ensemble techniques and these techniques are based on varying parameters related to design and training of ANN such as varying initial weights, varying network type, varying network architecture involving number of hidden neurons, number of hidden layer. To combine the networks, ensemble mean or weighted mean method is used so as each ensemble is assigned weights in such a way that root mean square error is minimized. Network is trained with different random initializations and 3 such models are selected for participating in the ensemble forecasting whose errors are better. The average output of the above 3 models is expected to give better results. We have modified the learning parameters of the network where a number of networks are built with different learning parameters, such as initial weights in an MLP and varying number of hidden neurons, etc. An alternate baseline approach we investigated was the creation of a simple
neural network ensemble where each network are trained independently and networks with
good correlation are selected then ensemble mean of these networks are taken. Likewise
hidden neurons are varied and then again same procedure applied. While theoretical results
indicate that, if properly constructed and employed, neural network ensembles can generalize
better than any individual model used separately, they do not provide general guidelines
about the selection of different models in the ensemble.

1.3 Superensemble neural network

Superensemble architecture for numerical weather prediction was proposed by
Krishnamurthy and others. This idea was an extension of the traditional ensemble mean
forecasting which could remove errors associated with initial condition. The idea was to first
take the ensemble forecast of individual models by using the perturbation theory and then
take an ensemble of the ensemble forecasts. Thus the superensemble model was capable of
taking into account the errors caused by wrong initializations as well as poor understanding
of the concerned deterministic system. This was called the Multi Model Ensemble (MME).
Ann superensembling is an extension of ensemble method which further improves the
performance of a network by providing high correlation and low root mean square error.
Several ensemble models are combined together to form a superensemble. We have used two
aspect to create a superensemble that is the initial weights and the architecture of the ANN
which essentially means the number of neurons in the hidden layer. Our baseline approach
was the creation of a simple superensemble network using two ways first where output of
various ensemble networks are combined during training phase to form a superensemble and
second where mean of various ensembles are taken. We have also created a superensemble
network where weighted mean concept is utilized and comparison between these results are
done to see which network performs better. It has been found that weighted mean concept
performs better than ensemble mean and gives a significant increase in correlation and root
mean square error is decreased. For weighted concept we used network with 12 hidden
neurons as it performed better then various weighted mean are statistically combined during
training so that skill of ensemble of ensemble is factored into superensemble. In
Consolidated ANN ensemble, output of weighted ensemble mean is fed into the network as
an input then the network is trained so that the output obtained gives better performance
producing good correlation and root mean square error is reduced.

1.4 The present study

Statistical prediction models such as the Artificial Neural Networks (ANN) tend to model the
dynamical behavior of the system based on past information. The errors in such techniques
can be due to wrong initializations as well due to wrong topology. The present study is aimed
to explore the ANN prediction errors in the context of wrong initializations and wrong
 topology by means of ensembling and Superensembling of the ANN models.
The predictability of dynamical systems are largely governed by two factors – (i) the
uncertainty arising out of initial conditions and (ii) poor understanding of the actual process
in question. Ensemble forecasting has been in practice since long to account for the errors due
to initial conditions. Multi Model Ensembling (MME) has been recently adopted by
researchers to take into account the errors due to lesser understanding of the subject.
Super ensemble architecture for numerical weather prediction was proposed by
Krishnamurthy and others (2000). This idea was an extension of the traditional ensemble
mean forecasting which could remove errors associated with initial conditions (Palmer et al.,
2004, Suzuki et. al., 2004). The idea was to first take the ensemble forecast of individual models by using the perturbation theory and then take an ensemble of the ensemble forecasts. Thus the superensemble model was capable of taking into account the errors caused by wrong initializations as well as poor understanding of the concerned deterministic system. This was called the Multi Model Ensembling (MME).

2. Methodology

2.1 Data

The extended reconstructed sea surface temperature from January 1871 to May 2004 (Smith and Reynolds, 2003, 2004, 2005) for the IO region (in the neighborhood of IOD) has been used for the present analysis. The SST for the Central Southern Indian Ocean (CSIO) and Southern Indian Ocean (SIO) has been averaged over the respective areas to obtain the time series for 23 years (January 1982 to December 2004).

2.2 Correlation Analysis

The determination of predictors is an important step as this is a precursor to a good prediction model. Autocorrelation analysis was done for the determination of predictors and also to establish the basis for an attempt to design such a prediction model. Lag values for the autocorrelation analysis have been taken from 0-24 months. Based on the correlation analysis we have selected predictors having highest positive correlations. Figure 2.1 shows the results of the autocorrelation analysis. It can be seen that the maximum correlations are obtained at values of 12 and 24 (0.8691 and 0.8461).

2.3 Partitioning of data

The data is partitioned into three datasets namely training, testing and validation set. The data set comprises of 23-year monthly data (from January 1982 to December 2004). This implies 1596 data points. The test set is obtained by serially taking the last 131 points. The remaining 1179 points are used for training and 262 points for validation.
Multilayer feed-forward neural network models are the most popular network paradigm for forecasting applications. Those factors related to neural network model architecture include the number of input variables, the number of hidden layers and hidden nodes, the number of output nodes, the activation functions for hidden and output nodes, and the training algorithm and process. The activation functions used for all hidden nodes are the logistic function while the identity function is employed in the output layer. The number of input nodes corresponds to the number of past lagged observations used to capture the underlying pattern here which is lag12 and 24. We used four levels of hidden nodes of 5, 6, 7, and 8 to experiment with in this study. For creating a ensemble network, we have used multilayer feed-forward architecture in which number of neurons in input and output layer is 2 and 1 whereas neurons in hidden layer are varied to create an super ensemble. To form an Consolidated ANN we have used outputs of weighted ensemble mean which is fed into the network as a input. We have used same activation function and architecture, the only difference is in the number of neurons in the input and output layer which is 3 and 1 as weighted ensemble of various networks are calculated with hidden layer neurons 8, 10, and 12. Networks are trained so that a particular input leads to a specific target output. The training algorithm is the standard BP, which uses the gradient descent technique to minimize error. During training, each desired output is compared with the actual target and calculates error at the output layer. The backward pass is the error back propagation and adjustments of weights. Thus, the network is adjusted based on a comparison of the output and the target until the network output matches the target. When the training process is completed, then the network with adjusted estimated parameters is used to test a set of data, which is different from the training set of data. We used two approaches for creating a superensemble:

i) Simple average of ensemble forecast then call it EANN

ii) Output of weighted ensembles are fed into the network as input then call it CANN which is consolidated artificial neural networks.

a) E5: specifies the ensemble output of various networks with 5 neuron in hidden layer likewise for 6, 7 and 8

E: Mean of various ensemble output

EANN: final output which is average of various created ensembles

E = E5 + E6 + E7 + E8/4

b) W8: is the output of weighted ensemble with hidden layer neuron 8 likewise for 10 and 12

CANN: output of various weighted ensemble are fed into network as a input then that network is trained to obtain a final output which is called Consolidated Artificial Neural Network.
3 Results and discussions

The performance is measured in terms of its RMSE (Root Mean Square Error), correlation. The correlation and RMSE is calculated and compared. The comparison shows the successful ANN model is developed. Initially a ANN model with 5 hidden neuron is defined. The RMSE and correlation of the target response with desired response is obtained. The analysis of all neural network with different neuron up to 8 is done and their RMSE and correlation are then compared. The best network that has least RMSE & more correlation between target & output is considered. This is repeated for creating ensembles by varying hidden layer neurons and then taking mean of these ensembles calling it super ensemble. The RMSE and correlation obtained is compared with ANN results and It has been found that super ensemble works better and gives better performance. Then weighted mean of ensembles is taken for hidden layer neuron like 8,10 and 12 using RMSE and correlation for measuring performance and obtained results are compared with both ANN and ensemble results. It is found to perform even better by providing significant increase in correlation and RMSE is reduced. Finally a Consolidated ANN is created by taking outputs of previously created weighted ensembles as input. The analysis of these obtained Consolidated ANN are done up to hidden layer neuron 12 and their RMSE and compared with previously obtained results yielding even a better performance by further increase in correlation and decrease in RMSE.

Table 3.1
The performance measurement of various ensemble techniques using correlation coefficient and root mean square error.

<table>
<thead>
<tr>
<th>Ensemble Criterion</th>
<th>Model details</th>
<th>CC</th>
<th>RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best individual ANN models</td>
<td>ANN5</td>
<td>0.80</td>
<td>0.075</td>
</tr>
<tr>
<td></td>
<td>ANN6</td>
<td>0.79</td>
<td>0.074</td>
</tr>
<tr>
<td></td>
<td>ANN7</td>
<td>0.80</td>
<td>0.074</td>
</tr>
<tr>
<td></td>
<td>ANN8</td>
<td>0.79</td>
<td>0.073</td>
</tr>
<tr>
<td>(E1) Simple Ensemble (Ensemble obtained by</td>
<td>EANN5</td>
<td>0.79</td>
<td>0.075</td>
</tr>
<tr>
<td>simple averaging of outputs of individual architectures with different initial conditions)</td>
<td>EANN6</td>
<td>0.79</td>
<td>0.074</td>
</tr>
<tr>
<td></td>
<td>EANN7</td>
<td>0.80</td>
<td>0.074</td>
</tr>
</tbody>
</table>
Simple Ensemble
(Ensemble obtained by simple averaging of weights of individual architectures with different initial conditions)

<table>
<thead>
<tr>
<th></th>
<th>EANN8</th>
<th>0.80</th>
<th>0.074</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensemble of outputs of ensemble ANNs in E1 (ensemble averaging)</td>
<td>WANN8</td>
<td>0.81</td>
<td>0.073</td>
</tr>
<tr>
<td></td>
<td>WANN10</td>
<td>0.80</td>
<td>0.073</td>
</tr>
<tr>
<td></td>
<td>WANN12</td>
<td>0.81</td>
<td>0.074</td>
</tr>
</tbody>
</table>

Super ensemble S1
Input of weighted ensemble outputs (E2) used to train a new ANN

<table>
<thead>
<tr>
<th></th>
<th>EANN</th>
<th>0.80</th>
<th>0.073</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensemble of outputs of ensemble ANNs in E1 (ensemble averaging)</td>
<td>CANN12</td>
<td>0.81</td>
<td>0.070</td>
</tr>
</tbody>
</table>

Figure 3.1 comparison of various ensemble techniques (a) ensemble averaging output compared with output (b) weighed ensemble compared with consolidated ANN

4 Conclusion
The method of multi model ensemble (MME) forecasting in dynamical scenario has gained considerable attention among the researchers during the last decade with the work of Krishnamurthy and others. It was found that the ensemble of ensemble forecasts leads to better prediction. The logic behind this is that while ensemble forecast removes errors that creep in due to incorrect model initialization the multi model ensembling removes errors due to poor model physics. In both cases the logic behind removal of errors is the concept of averaging. Averaging removes the chaotic factors in the output. Simple ensembling removes errors due to incorrect initializations and MME removes errors due to poor understanding of the problem.

It was, however, further seen that MME does not always lead to better prediction. In some cases ensemble forecast or even individual mode forecasts offer better results. Statistical forecasting depends on the observations made in history. A common factor in statistical and dynamical forecasting is that both utilize the property of the system that there is an underlying dynamics playing behind seemingly random behavior of the parameter. Further, there are two broad categories of statistical prediction models. The regression based models which don’t require any learning and the ANN type which evolves in time. The regression based models have no concept of initialization or ensemble. The ANN models, on the other hand, are dependent on initializations. Further, predictions based on these models are highly dependent on the number of hidden layers neurons. Thus there are two sources of errors in the predictions done by ANN models. This raises a pertinent question. Whether the ensemble forecast with ANN correspond to the ensemble forecast of the dynamical models.

The errors due to incorrect model initialization are reduced by taking several initializations and averaging the outputs. This can be called ensemble forecast. The errors due to incorrect model development resulting by taking wrong number of neurons in the hidden layer can be reduced by taking average of models with different number of neurons in the hidden layer. This is called MME forecast in statistical scenario. In the present study we call such ensemble as a superensemble.

The present study investigated the effect of ensembling and superensembling in context of ANN predictions. SST time series in a region of Indian ocean was analysed for predictability by ANN, ANN ensemble and ANN superensemble. Two approaches to ANN superensembling were discussed. It was observed that ensembling and superensembling of ANN models does not lead to better predictability of the SST. It can thus be concluded that it is better to take individual ANN forecast than taking ensemble and superensemble forecast. In past several studies have been undertaken to demonstrate the better prediction capability of ensemble ANN models than individual models. However, there are no theoretical justifications provided for the same. In light of the past and present results it can be concluded that ensembling of ANN models needs further investigation. Conclusive decisions shall either be provided by sound theoretical justifications for the use of superensemble models or by carrying out more such studies either to prove or disprove the claim.

5 References


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The Impact of Academic Motivation on Student’s Academic Achievement and Learning Outcomes in Mathematics among Secondary School Students in Paddiruppu Educational Zone in the Batticaloa District, Sri Lanka.

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Abstract

The objective of the study was to investigate the relationship between student’s Academic Achievement (AA) and learning outcomes (LO) of mathematics as an impact of Academic Motivation (AM) among the junior secondary students in type II School in Paddiruppu Educational zone, Batticaloa district. The study was carried out on 300 junior secondary students randomly selected (grade 9 which are transformation group from junior secondary to senior secondary grade 10) from 10 semi-urban and rural type 2 schools, and schools were stratified randomly selected from Paddiruppu Educational zone. The age ranged from between 13.5 and 14.5 years (who were stayed in grade 9, the year of 2016). Other variables considered in the study are extent of AM at two levels that is highly motivated and less motivated students.

This research is an ex-post facto design in the sense that the researcher does not have direct control over independent variable because their manifestations have already occurred or because they are inherently not manipulable. The investigator therefore examined the impact of AM (independent variable) on type II schools grade 9 (early adolescence) students AA in Mathematics (dependent variable). In an effort to achieve this, study investigated the impact of AM on student’s school AA in mathematics in secondary type II schools using AM for academic performance scale (MAPQ) as a measuring instrument and achievement test in mathematics were gathered through mid year examination test in mathematics, in July 2016.
Two hypotheses were tested for significant at 0.05 level and using t-test and analysis of variance (ANOVA). Results showed that gender difference were significant when (t. calculated value = 8.9; t critical value 1.96; df = 284; at 0.05 level) impact of AM on AA was compared in male and female students. Also other result indicates significant difference when (t. calculated value = 7.9; t critical value 1.96; df = 284; at 0.05 level) extent of motivation was taken as variable of interest on AA in mathematics based on the degree of their motivation, suggestions and recommendations on students, parents government, counsellors, educational stakeholders etc, were discussed.

Keywords: Academic Motivation (AM); Academic Achievement (AA); Learning Outcome (LO); Secondary type II School; Junior Secondary Students; Mathematics.

Introduction and Background of the Study

In the contemporary Sri Lanka, greater emphasis is being placed on Industrial and Technological development (contribution of developed countries, i.e. specially Japan and China). As a result students are being encouraged to take up science subjects. One subject that cut across all the science is mathematics. Today, mathematical methods pervade literally every field of human endeavour and play a fundamental role in economic development of a country. In our match towards scientific and technological advancement, we need nothing short of good performance in mathematics at all levels of schooling. Unfortunately performance of students in mathematics at the end of secondary education has not improved in the past decade.

Various factors have been adduced for poor performance of students in mathematics. The interest of students in mathematics have been related to the volume of work completed, students task orientation and skill acquisition, students personality and self-concept, feeling of inadequacy (Callahan, 1971), motivation, self-confidence, and anxiety (Aiken, 1976), shortage of qualified mathematics teachers (Ohuche, 1978; Ale, 1989), poor facilities and equipment and industrial materials for effective teaching (Oshibodu, 1984; Odogwu, 1994), use of traditional chalk and talk method (Oshibodu, 1988), large pupils to teacher ratio (Alele-Williams, 1988) mathematics fright/phobia (Georgewill, 1990) and so on. Wentzel (1998) stated that interest in activities tends to increase the likelihood that individuals formulate goals relating to that activity and invest time and effort to achieve them.
Moreover, individual characteristics such as intelligence, cognitive styles, and personality play an important role in learning and instruction as does the context of learning. Other research findings have shown that individual students’ characteristics variables such as motivational orientation, self-esteem and learning approaches are important factors influencing academic achievements. In the effort to improve students cognition and affective outcomes in mathematics and/or school learning, educational psychologists and mathematics educators, have continued to search for variables (personal and environmental) that could be manipulated in favour of academic gains. Of all the personal and psychological variables that have attracted researchers in this area of educational achievement, motivation seems to be gaining more popularity and leading other variables.

**Review of the Literature**

The issues of academic motivation (AM) of students in education and the impact on academic achievement (AA) are considered as an important aspect of effective learning outcome (LO). However, a learner’s reaction to education determines the extent to which he or she will go in education. The impact of academic motivation on education of mathematics of a child cannot be undermined. That is why Hall (1989) believes that there is a need to motivate students so as to arouse and sustain their interest in learning mathematics. “Academic Motivation raises question on why people behave in the way they do it”. An individual could therefore, from psychologists’ point of view, be seen as politically, socially and academically motivated depending on the motivate behind his or her activities.

Based on the foregoing, research on mathematics academic achievement should be considered a continuous process until there is evidence of improvement in interest and performances of the learners in the subject particularly the secondary school students. Essentially therefore, the present study is an effort in this direction. Hence the study investigates the impact of motivation on student’s academic achievement.

The experimental researchers carried out by some researchers have tremendously improved the knowledge about the motivate to achieve (Gesinde, 2000). Academic motivation could be seen as self-determination to succeed in whatever activities one engages in, be it academic work, professional work, sporting events, among others. Gesinde (2000) posits that the urge to achieve varies from one individual to the other, while for some individuals need for achievement is very high whereas for others it may be very low. However, there are high
achievers and low achievers. What is responsible for the variation could be the fact that achievement motivation is believed to be learnt during socialization processes and learning experiences. As a matter of fact this varies from one individual to the other. Gesinde (2000) asserts further that, those who have high achievers as their models in their early life experience would develop the high need to achieve, while those who have achievers as their models hardly develop the need to achieve.

Human being are said to be extrinsically or intrinsically motivated. Intrinsic motivation is said to be derived internally in the job itself. It is that which occurs while a person is performing an activity in which he takes delight and satisfaction in doing. Intrinsic motivation is seen as internal rewards, while extrinsic motivation is incentive or rewards that a person can enjoy after he finishes his work. Okoye (1983) opined that motivation holds the key to the understanding of human behaviour. According to him, motivation explains why one individual dodges work, another works normally satisfactorily enough to reach the height, while yet others resort to illegal and unconventional methods of achieving social, academic, economic and political recognition. He added that motivation should be carefully manipulated whether in the work situation or study situation, so that our students are neither under motivated or over motivated but appropriately motivated so as to be useful to themselves in their society and the world at large.

Akinsola (1994) investigated the relationship among college students’ learning and performance goal orientation, drawing on questionnaire data from ages 17-22 of college students’ total 312. It was reported that students who had a learning profile motivation had completed more semesters. They concluded that the younger students who were externally motivated tended to posses more irrational beliefs while other internally motivated students tended to be more involved in learning.

George wills (1990) hypothesised that conceptions of success of achievement goal affect both the inclination to and actual performance. This was tested in a sample of 673 Chinese adolescents. Sex differences were found in the conception of success. As part of larger project concerned with motivation factors in educational attainment Sinna et.al. (1998) focussing on Asian girls, 985 secondary school students in London and England found that Asian students of both sexes rated parents and friend as more important in contributing to academic success. Yoloye (1976) carried out a descriptive survey on the cause of poor academic achievement in Northern Nigeria. He reported that majority of the children who
were labelled as backward or unintelligent to school were good, but they were handicapped by physical characteristics such as defective vision, learning defect and other preventable diseases. Bridgeman (1978) reported that standard school achievement test is somewhat predictive of later academic performance.

Bank and Finlapson (1980) found that successful students were found to have significantly higher motivation for achievement than unsuccessful students. Moreover, (Johnson, 1996; Skaalvik and Skaalvik, 2004) revealed significant relationship between academic performance and motivation. In Nigeria, a study carried out by Akinsola (1994) on academic motivation using 276 students revealed that there is an agreement between academic performance and motivation.

Objective of the Study

The study sought to explain learning outcomes in senior secondary mathematics in terms of academic motivating students towards academic gains in the subject.

Hypotheses

1. **Hypotheses H0** – There are no significant relationship between the impact of motivation and academic performance of male and female students in mathematics.

2. **Hypotheses H0** – There are no significant relationship between the academic performance and highly motivated and lowly motivated students in mathematics achievement test.

Methodology

The causal-comparative model was used by investigator this ex post facto design research investigation. Using this model, the investigator hypothesizes the independent variable and then compares two groups, an experimental group (E) which has been exposed to the presumed independent variable X (Motivation) and a control group (C) which has not. (The dashed line in the model shows that the comparison groups E and C are not equated by random assignments).

<table>
<thead>
<tr>
<th>Groups variable</th>
<th>Independent variable</th>
<th>Dependent</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>X</td>
<td>O₁</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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O₁ – Academic Achievement O₂ – Learning Outcomes in Mathematics

1. Research Design

This study used the survey design which involves the collection of data at current status for description of phenomena, without deliberate effort to control the variables. The study adopted the expo-facto type using the descriptive survey design type. This research is an ex-post facto design in the sense that the researcher does not have direct control over independent variable because their manifestations have already occurred or because they are inherently not manipulable. The investigator therefore examined the impact of academic motivation (independent variable) on type II schools grade 9 (early adolescent) student academic achievement in Mathematics (dependent variable).

2. Population and Sample

A simple survey design was adopted for this study. The study was directed at the population of senior secondary type II School; grade 9 (early adolescent) students in Paddiruppu zone. The target population for the study comprised all the students in junior secondary students in grade 9 in Paddiruppu educational zone. This zone is one of the 14 zones in eastern province in Sri Lanka. It has cultural and educational similarities with the other zone in the eastern province of Sri Lanka. The schools in Paddiruppu zone were stratified into semi-urban and rural schools. There is no urban school situated in this zone. A stratified random sample of 10 type 2 schools (5 semi-urban and 5 rural schools were used) was selected for this study. A stratified random sample procedure was used to select semi-urban and rural type 2 school from the list of schools in the Paddiruppu zone. Equal number of semi-urban and rural schools was chosen. From each of these selected schools, 30 students were randomly selected to make a total of 300 respondents that constituted the sample for this study and included male and female students. The average age of the students is 14.0 (early adolescent). The schools situated in area served by semi-urban and rural were considered by Piradesasaba. Other variables considered in the study are extent of motivation at two levels that is highly motivated and less motivated students.
3. Instrumentation

The following research instruments were selected and used in the study. The main instrument for collecting data was a questionnaire. The questionnaire was selected as the chief method because of its many advantages. It gives maximum coverage of the field of study, in comparison with other tools of student’s motivational aspects. A modified instrument tagged Motivation for Academic Performance Questionnaire (MAPQ - Standard) was used to gather data on the study. Items in the instrument were adapted from Motivation for Occupational Preference Scale (MOPS - Standard) by Bakare, (1977) and Motivation for Academic Study Scale (MASS - Standard) by Osiki, (2001). The instrument was divided into two parts. It consists of section A which is made up of 10 questions dealing with the participants demographic information like sex, age, class, name of school etc; while the section B contain the items. It was a thirty items scale of likert type question format (five point scale) with response ranged from strongly agree 5, to strongly disagree 1. To ascertain the reliability of the instrument after modification, it was administered on 25 respondents who were secondary type II School students selected from another two secondary type II schools which were not part of the study sample. The reliability co-efficient yield an $r = 0.79$ through cronbach alpha. All the items in the instrument were really very relevant to the content of the study. Data on academic performance were gathered through mid year examination test in mathematics, in July 2016. This common examination mathematic question paper has been prepared and constructed by special mathematic consultant (In Service Advisor - ISA), resource centre, batticaloa district. The reliability of the instrument was found to be 0.81 using test re-test reliability method of two weeks interval.

Data Collection, Analysis and Results

All the 300 participants were administered the Motivation for Academic Performance Questionnaire (MAPQ). The mathematics teachers in the participating schools assisted during the administration of the instruments. Instruction on how to respond to the questionnaire was read to the participants. This ensures its proper filling. Data collection was done immediately after the administration and all the response sheets were retrieved from the respondents. Out of 300 questionnaires administered, 286 were valid for the analysis on the study. After completed this activities the respondents mathematics achievement marks (Mid year zonal examination, in July 2016) received from respective subject teacher according to the marks schedule, who were participated this study.
Data collected on the study were analysed using inferential statistics which includes; student t-test and analysis of variance (ANOVA). Specially, the study provided answers to two research hypotheses. The sequence of the presentation of the results is in accordance with that of the hypotheses. In this study, two null hypotheses were tested for significance level at 0.05 margin of error. The results of the study were presented in tables below.

The first hypothesis states that there is no significant relationship between the impact of motivation and academic performance of male and female students in mathematics. Table 1 presents the results of the analysis conducted on the impact of academic motivation on academic achievement in mathematics based on gender. The results clearly reveals that significance relationship exists in the academic achievement of male and female student in mathematics with, t. calculated value = 8.9; t. critical value = 1.96; df= 284; at 0.05 level. Which means this hypothesis is rejected.

**Table 1: t – test showing the mean difference in the impact of academic motivation on academic achievement of male and female students in mathematics.**

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Df</th>
<th>t – calculated value</th>
<th>t- critical value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>129</td>
<td>36.62</td>
<td>13.79</td>
<td>284</td>
<td>9.16</td>
<td>1.96</td>
<td>S*</td>
</tr>
<tr>
<td>Female</td>
<td>157</td>
<td>42.48</td>
<td>15.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

S* - Significant at 0.05.

The second hypothesis states that there is no significant relationship between the academic performance and highly motivated and lowly motivated students in mathematics achievement test. Table 2 shows academic achievement measured alongside extent of motivation. The results reveals that there is significant relationship between in the academic achievement of highly motivated and lowly motivated students in mathematics with, t. calculated value = 7.9; t critical value = 1.96; df= 284; at 0.05 level.

Table 3 shows that significance on gender and academic achievement as clearly stated. The calculated F-ratio is 21.67.

**Table 2 : t – test showing mean difference summary of academic achievement of Highly motivated and Lowly motivated students in mathematics.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Df</th>
<th>t -</th>
<th>t-</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3: ANOVA Source Table of Summary of Gender Difference and Academic Achievement in Mathematics.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>Df</th>
<th>MS</th>
<th>F-ratio</th>
<th>F-critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>231269</td>
<td>1</td>
<td>86385</td>
<td>21.67</td>
<td>3.63</td>
</tr>
<tr>
<td>Within</td>
<td>14655</td>
<td>284</td>
<td>34.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>245924</td>
<td>285</td>
<td></td>
<td>S*</td>
<td></td>
</tr>
</tbody>
</table>

S* - Significant at 0.05

Discussion, Suggestion and Recommendation

1. Discussion

The result of the first hypothesis, which compares the impact of academic motivation on academic achievement of secondary type II school students in mathematics using gender as a variable of interest is found to be significant. The finding shows that motivation has impact on academic achievement of secondary type II school students in mathematics with respect to gender. This finding is in disagreement with Siana et.al, (1998) findings that Sri Lankan students of both sexes rated parents and friends as more important in contributing to academic success. The variation in the present result on this study and that of Siana et.al, (1998) may be connected with the issue of environment. While the present study was conducted in Batticaloa, Sri Lanka. His study was conducted in Asia. Meanwhile, one thing that should be very clear is the fact that success in school subject or academic generally depend on many motivating factors. The issue of gender is part of it likewise parental involvement/support and or peer influences. All these should not be underrated because they are factor that can make or mar student achievement in school.

The result of the second hypothesis shows that secondary type II School students differ significantly in their academic achievement based on the extent to which they are motivated.
The results reveal that highly motivated students perform better academically than the lowly motivated students. This finding corroborates that of Bank and Finlapson’s (1980) finding who stressed that successful students have significant higher motivation for achievement than unsuccessful students. Similarly, the report by Johnson (1996) that academic achievement is highly correlated with student’s motivation lends a good support to the present findings. With reference to the position of (Ayotola, 1998), that when pupils express lack of interest in the subject, it affects the way they react or listen to the teacher. It can be said interest and attitude of learner towards a particular subject matters a lot. This is because these two constructs according to the author are high motivating factor which can lead to better achievement on the part of the learner. Good attitude and better interest learners display particularly in mathematics serve as an encouragement even to the teacher. And this can help the teacher a lot to disseminate his teaching to the best of his ability and knowledge making use of all available resources rather than resorting to the use of chalk and talk when learners show no interest or negative attitude. Moreover, when the students display good attitude and better interest in mathematics, the teacher is motivated and this may cause him to forget whatever hindrances to the teaching of the subject from his own part. Good impartation of mathematics knowledge on the part of the teacher; couple with student’s interest in the subject and the display of positive attitude as earlier pointed out, are good motivating factors which when combine together is assumed will result to better achievement in mathematics.

2. Suggestions

From all views, discussed in the literature review, some of the suggestions use can bring out as ways of motivating students to learn are;

- Make mathematics teaching interesting.
- Individual differences in ability, background and attitude must be taken into consideration.
- Enhance learners feeling of esteem by arranging varieties of learning experiences according to Biehler and Snowman (1986); “Try to send your students away from your institution anxious to use what they have been taught and eager to learn more by associating subjects with liked and admired situations, things or individuals and also arranging conditions so that students feel comfortable when in the presence of a subject”.

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All these suggestion must however be transformed into actual practice within the framework of the school curriculum. More especially, with the case of mathematics education, these suggestions could be guidelines in deciding the types of methods/strategies or instructional materials/media, which could be used in motivating pupils to learn mathematics.

3. Recommendation

The findings reported in this study justify the importance of motivation to academic performance. The findings have implications for the teachers of mathematics that they should try as much as they could to motivate their students during the course of instructions. The parents as well as the government should engage in programmes that can motivate the students to improve their academic performance. It is therefore, hoped that these findings will serve as resource materials for mathematics educators, mathematicians, school authorities psychologists, counsellors, government, parents and significant others who are connected with the academic progress of the students.

Bibliography


THE NEW GREAT GAME IN SOUTH ASIA: THEORISING THE GEOPOLITICAL OUTFOXING OF INDIA

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Abstract: China has been taking more active interest in South Asia, particularly since last two decades. China's evolving South Asia policy hinges on multiple factors, which are strategically-driven, politically-oriented and economically manifested. The core issues of China include manifold interests and concerns like peripheral stability by curbing extremism, outdo India-US influence in the region, thwart India’s rising influence in South Asia, continuity of fast growing economy by securing safe access to Indian Ocean routes, rallying friendship and entering the littoral states through aid and investment process, are crucial considerations of China’s policy towards South Asia. Therefore, China has adopted an approach to handle the relationship with South Asian countries as a whole with utmost care to ensure strategic and security objectives. Against this backdrop, this paper would be an attempt to answer a question how China’s geopolitical and geostrategic manoeuvrings regarding ‘New Great Game’ outdo India in South Asia.

Key Words: Great game, South Asia, China, India, Dominant power.

Introduction: The New Great Game refers to the geopolitical and geostrategic competition for influence, power, hegemony and profits predominately between China and India in South, Southeast and Central Asia and the Indian Ocean region. The historic 19th century ‘Great Game’ seems to be in the process of revival, although in different settings with different actors and competing interests. Rudyard Kipling, states that the Old Great Game- a reference to the 19th and 20th-century competition for influence in Asia between Russia and Britain, now has a new competitors. Instead of an expansionist Russian Empire confronting Imperial Britain, it is now China voracious for political, terrestrial and maritimespace and raw materials for which both have flexed their muscles. China has been intruding in South Asia and directly/indirectly challenging India. According to Pandita (2016), the ‘New Great Game’ appears to be moving to the South Asia where the actors are no more interested in building empires as the case was in old Great Game, but have been in search of greater amount of influence in political, economic, social and defence fields in order to have superseding status in the region. They have been acting independently, sometimes in collaboration without losing attention of their respective competing/mutual interests. The original Great Game saw Britain and Russia manipulating and intriguing against each other across most of the Asia at the end of the nineteenth and twentieth centuries, from the Gulf to the Pacific. Likewise, it has emerged between India and China in the 21st century amidst various intersecting interests.

India and China have been emerging as the key actors in the South Asian region with fast moving upward trends of power course-be it economic, military or technological. Their rise and competition have been significantly affected the geopolitical and geostrategic dynamics of the region. Both the powers have been harbouring global power aspirations and striving to achieve them for the given of their fast growing economies, modernization and expansion with capabilities of nuclear weapons, exponential growth in defence
budgets combined with massive workforce reserves. As a result, they have been competing for influence in South Asia and other adjoining regions. No doubt the initial period of relations between the two countries was somewhat cordial, but it did not last long when China invaded India in 1962. Since then, the two neighbours have remained on opposites. The strategic competition has been continuing to escalate between the two giants. The Sino-India New Great Game actually pertains to territorial disputes, competition to secure resources, formation of strategic military alliances and the use of strategic relationships with other major and regional powers to contain/curb the rising geopolitical and geostrategic influences. Scott (2008) while describing the competition between the two powers, states that China’s ‘Great Game’ is the curtailment of India’s rise and vice versa because China is conscious about India’s potential of challenging it in South Asia and beyond where their interests and influences will collide (Scott, 2008).

**China and India in the South Asia: Constructive/Conflicting Perceptions**

China’s location does not fall within the geographical confines of South Asia but its influence has a pivotal position in the regional geopolitics for the given her power regarding geography, demography, military, economy and friendly relations with almost all the South Asian states. China has emerged successful in maintaining the substance, strength and stability in its relations with the region except for India with whom the relations have been undergoing bitter and hostile experiences. Its independent foreign policy and five principles of peaceful coexistence have been yielded significant dividends of constructive engagement with the region. China’s policy towards South Asia is based on a mixture of mutual convergences, characterised by economic opportunities, territorial disputes, security fears, containment of India and resisting the US influence.

The policy adopted by China about South Asia is in line with the security of its overall national strategic interests like peaceful periphery particularly south-western frontier regions of Tibet and Xinjiang and uninterrupted economic activities. In pursuit, China’s policy hinges on to maintaining regional peace and stability using diplomatic influence and balance of power. Also, China is interested in winning the regional countries in manifold cooperation, economic tie ups and friendly dealings and to evade resentment by adopting a neutral posture in regional conflicts. China is judiciously pursuing its policy to generate enough security measures for the security of SLOC’s which are critical to sustaining the fast growing economy. China’s further objectives are to increase its influence to have safe access to oil and the gas-rich Middle East, Central Asia and the Caspian Sea resources and to break the US strategic encirclement of China and to contain the rise of India in the region.

India has always been interested in maintaining a peaceful policy towards its neighbours to have cordial and close relations mandatory for India’s progress, with all these countries right from the independence. But the conflicts have often been cropped up between India and its neighbours. They have displayed hostile attitude towards India at many instances either at the behest of external powers or due to the unresolved issues of borders, water sharing or other. The development of cordial relations hampered because India was at times accused of trying to act as a hegemon which is trying to dominate the small neighbours in the region. India is being viewed with suspicion for having vast territory, largest population, leading military strength, and a nuclear capable power. These factors have generated a continued fear of India’s expansion and domination in terms of...
trade and other matters, and interference in national affairs in the region. Till date, India has achieved little success in solving all the disputes and clearing all mistrust with neighbours especially Pakistan, because they demand unnecessary concessions from India which is impossible for India in view of its national interests. India always insisted on solving the issues bilaterally and peacefully, but the neighbours always created hurdles.

Competing Interests and Geopolitical Responses

The Great Game of China is the containment of India’s rise and influence so that it may not hurt Chinese interests in the region. This was explicitly acknowledged by the statesmen and scholars of both the countries. Guihong stated that “An emerging India does mean a strong competitor for China from South, West, Southeast and Central Asia to Indian and Pacific Oceans where their interests and influences will clash” (Ibid). China’s tremendous growth in power and its presence around India both on land and sea has worried India. The then Defence Minister Fernandes stated in 1998 that “China is potential threat number one . . . China is and is likely to remain the primary security challenge to India in the medium and long-term . . . The potential threat from China is greater than that of Pakistan and any person who is concerned about India’s security must agree with that”. Khanwal (1999) also opined that Chinese activities “clearly indicate that concerted efforts are underway aimed at the strategic encirclement of India . . . Quite obviously designed to marginalise India in the long-term and reduce India to the status of a sub-regional power . . . It [China] is unlikely to tolerate India’s aspirations to become a major regional power in the Asia-Pacific region”.

The encirclement of India by China starts from the north where China directly controls Xinjiang and is growing its grip in Central Asia and unique in this direction is the control on Tibet—being regarded as part of original Great Game. From the western side, another land threat for India comes from the China’s friendship with Pakistan. From the South, the distress comes from the China’s entry in the Indian Ocean with the establishment of base facilities and exploration rights in Sri Lanka and Bangladesh. The discomfort from the east lies with the presence of China in Myanmar and Bangladesh where China has developed base facilities.

Recognising the Chinese activities, India has resorted to strategically respond to China’s threat by enhancing power projection through the building and modernising its military and nuclear capability. India is busy in counter encircling the China both on land and sea though not up to the level as China has done. India has improved its Military infrastructure along its disputed northern border thereby enabling more efficient future deployment of military power. Also India’s efforts are afoot to strengthen its grip over Nepal and to interfere in Tibet by providing refuge to Tibetan government in exile. India has made some amount of military penetration in Tajikistan.

If China has superiority over land, India, of course, has maritime superiority. India has developed maritime infrastructure pretty well. The deep sea port facilities on the south-west coast at Karwar and on the south-east coast some 50 kilometres south of Visakhapatnam will help India to flex its muscles around the Indian Ocean further. It will enable India to more easily cut China’s Sea Lanes of Communication between the Persian Gulf and Straits of Malacca. The building of Campbell Airport on Great Nicobar Island, setting up of Far Eastern Naval Command (FENC), at Port Blair in the Andaman Islands provides a strategic advantage to India. These will help India to overcome the problems of Himalaya’s to operate and strike southern and central Chinese
zones. India’s maritime ties with Vietnam and Singapore and the development of ‘Quadrilateral alliance’ involving US, Japan, Australia and India are considered beneficial to contain China. Noting such a development of power, Daly stated that China must consider the growing naval power of its adjacent military rival, India (Daly, 2004).

**New Great Game in South Asia: China’s Expanding Geostrategic and Geopolitical Foot Print**

China has amply made her presence in the South Asian countries in recent years by taking advantage of their dire need for infrastructure development and their requirement of financial assistance for major infrastructure projects and the exploitation of their natural resources. Now China, an arch-rival of India, has been entering its neighbouring markets more aggressively through aid, trade and investment, economic assistance popularly known as Soft Power. Chinese economic engagement in South Asia has grown quickly in recent years. Trade expanded to $12.29 billion, and the regional trade crossed $111 billion. These increases create opportunities for growth and development as abroaderrange of exports flow from China into the region and Chinese outward direct investment improves infrastructure and creates jobs (Brunjes et al, 2013). This increasing involvement may be detrimental to India’s engagement with these neighbours regarding trade, investment and other bilateral issues.

Amongst the South Asian countries, China has been sharing direct borders with India, Pakistan, Nepal, Bhutan, and Afghanistan. Bangladesh, Sri Lanka. However, Maldives has been geographically detached from China, with no territorial dispute. Typically, India has no contentious issues with the South Asian countries apart from India and a minor with Nepal while India has aborder dispute with many of its neighbours. India’s contentious issues with its neighbours in the region threatened its policy towards the South Asia comprises of a combination of strategic and opportunistic dimensions. China is working vigilantly to achieve long-term strategic objectives and subsequently not missing short-term opportunities that come its way.

**China-Pakistan Strategic Friendship: Proven Reality**

China has prioritised to befriend Pakistan keeping in cognizance the long-term strategic and economic objectives there. The undercurrents of the relationship improved only after Indo-China War in 1962. During the war, the US had supported India, which was considered as a betrayal by Pakistan on the part of US. The souring of US-Pakistan relations gave an opportunity to China to strengthen ties with Pakistan (Kemenade, 1971). Strategically, China believes that the only possible way to avoid military conflict with India is to develop high military capability in Tibet, and a strong Pakistani military capability in the nuclear and conventional fields. This means keeping India entangled in two fronts—west and east. China is singularly responsible for making Pakistan a nuclear power besides continuously arming it with conventional weapons to India’s discomfiture.

China have provided non-stop assistance to Pakistan for developing its nuclear weapons program like nuclear warhead designs and highly enriched uranium (HEU) for almost two nuclear bombs (Mian, 2012). China extended nuclear assistance to Pakistan, with the construction of a 40-Megawatt safeguarded thermal heavy water reactor at Khusab and supplied the 300 MW pressurised water reactor (PWR) at Chashma that gave
Pakistan the technological capacity to produce more powerful warheads. Such a large assistance to Pakistan is said to have been completely aimed at India. In 2004, China built a second PWR at Chashma under the NSG’s provisions. In March 2010, Beijing’s state companies signed an agreement to supply Chashma 3 and 4, two PWRs of 320 MW capacity in defiance of the NSG norms. In October 2016, The Chashma, Unit-3 nuclear power plant with the power generation capacity of 340 Megawatt has become functional (Kerr and Nikitin, 2016). Nuclear experts rejected this rationale as a “deliberate disregard of international guidelines (Frankel, 2011). U.S. intelligence assessments in January 2011 concluded that Pakistan had deployed nuclear weapons numbering 110, overtaking India and is now on course to become the fourth largest nuclear weapons state ahead of France (Ibid).

China delivered 50 additional JF-17 fighter jets to Pakistan after the death of Osama bin Laden, assisted Pakistan in building its first indigenously built frigate a month later and in August 2011 launched a communications satellite for Pakistan. Along with M-9 and M-11 nuclear-capable ballistic missiles, China helped in transferring Taepo Dong and No Dong ballistic missiles from North Korea to Pakistan. Both nations have jointly developed JF-17 Thunder/ FC-1 Fierce fighter aircraft, the Al Khalid- main battle tank, and anti-tank missiles. The scope for joint production has also created apprehension in India’s security establishment, as it is a cost-effective means of enhancing Pakistan’s military capacity and capabilities. In January 2012, the Chinese Ambassador to Pakistan underscored the country’s strategic importance by declaring it ‘the fulcrum of Asia (Kanwal, 2015). Pakistan and China carry out military exercises every two years and have tested their capacity to conduct operations from a joint command centre, including simulation of large-scale intelligence gathering by Chinese and Pakistani troops, and search-and-destroy missions.

China’s deliberation to develop Pakistan economically is intended to keep Pakistan stable and to avoid terror fallout into the Chinese territory of Xinjiang and access to the crucial maritime routes to secure China’s energy deliveries through the Strait of Hormuz and the Persian Gulf and to get access to the energy resources in Pakistan particularly in Balochistan province. The latter would also allow China to expand its energy routes by bypassing Indian and US influence in the Indian Ocean and the South China Sea. Also, assistance to Pakistan keeps perceived Indian ambitions in check, as Indian and US observers become more concerned about Chinese maritime ambitions regarding the ‘String of Pearls’.

China is largely interested in Pakistan’s trade and energy corridor, from the Gwadar port of Pakistan to the Western regions of China, that would connect China with oil routes in Western Pakistan. Pakistan consented the entry of around 7,000 to 11,000 Chinese workmen in Pakistan administered Kashmir, and Gilgit-Baltistan region. They are engaged in the construction of a high-speed rail and road link from eastern China to the Chinese-built naval port of Gwadar in Baluchistan, east of the Persian Gulf (Harrison, 2010). An agreement was signed in 2007 between Pakistan Railways and China’s Dong Fang Electric Supply Corporation for linking Havellian and Khunjerab (Haider, 2007). Better rail connectivity within Pakistan will provide faster access to energy-rich Central Asia and the Persian Gulf states for China. On 20-21 April 2015, China’s president Xi Jinping arrived in Pakistan and signed 51 MOU and projects worth $46 billion dollars in the fields of security, infrastructure, energy, and wider economic development. Among these, $34 billion are to be invested in energy and $12 billion in infrastructure projects. An estimate of $15.5 billion would be spent on coal, wind, solar, and hydroelectric projects. Out of the total 51 agreements signed, 31 relate with the construction of China-Pakistan
Economic Corridor (CPEC) connecting China’s Xinjiang autonomous region to Gwadar Port on the Arabian Sea (Haider, 2015). The CPEC consists of rail, road and pipelines to transport oil and gas from Gwadar port on the Arabian Sea to Kashgar in China’s Muslim-dominated Xinjiang province through PoK. This route can be used as an alternative route over the pirate-prone Strait of Malacca route through which China currently transports most of its crude oil imports.

Between 2004 and 2009, China’s cumulative bilateral assistance to Pakistan totalled $217 million an average of $36 million per year (Wagner, 2011). As of 2011, China provides financing to Pakistan in the form of grants, concessional loans, preferential buyer’s credit, and export and buyer’s credit, amounting to $1.75 billion. The current level of Chinese development assistance to Pakistan is around US$21 million. By 2010, it was estimated that the total Chinese investment in heavy engineering, power generation, mining, and telecommunications was around $15 billion. The strengthening of the China-Pakistan alliance in scores of bilateral agreements, pacts and MOUs for cooperation in space, defence, technology, infrastructure and trade was on climax during Premier Wen Jiabao’s visit to Pakistan in December 2010. Wen considered the relationship as going beyond bilateral cooperation to exert influence on broader regional and international issues (Kronstdet, 2009).

China’s Strategic Foothold in Bangladesh

China and Bangladesh established diplomatic relations four decades ago. China and Bangladesh have deepened their bilateral cooperation in areas such as investment trade, defence, and infrastructure development. Important accords were signed during Prime Minister Khaleda Zia’s visit to China in 1995, regarding Chinese assistance in the development of gas and energy resources, and management of water resources (Kibria, 2006). Three treaties and a Memorandum of Understanding were signed during Prime Minister Khaleda Zia’s visit to China in December 2002 covering military, economic, and technological cooperation between the two countries (Aneja, 2006). In 2011 alone, it invested some US$ 200 million (Islam, 2013). It is noteworthy to mention that in the year 2009-2010, China was the third-largest investor in Bangladesh after Saudi Arabia and South Korea. During the period, 12 projects worth US$21 million were recorded. China built six bridges in Bangladesh, the important one is 4.8 km-long Mukhterpur Bridge over the river Dhaleswari, inaugurated on February 2008 (Rashid, 2011). The agreement to build the 7th China-Bangladesh Friendship Bridge at Kajirttek in Madaripur was signed in January 2012 and the consultations are ongoing about the 8th China-Bangladesh Friendship Bridge (Islam, 2013). Bangladesh was offered Taka 6 million in free aid when Chinese Foreign Minister Dr. Yang visited Bangladesh in 2008 for development and Taka 5 million in “token gift” to mark his visit (Daily Star, 2010). Peaceful Usage of Nuclear Energy was signed, whereby China would assist Bangladesh in the peaceful development of nuclear energy for power generation, medicinal and other developmental uses.

Bangladesh depends heavily on China for its defence requirements. Also, China sees its foothold in Bangladesh as part of its quest to establish its power profile and as a means to challenge India. This quest leads China to play an active role for Bangladesh in providing military hardware and training to its armed forces. In 2002, China and Bangladesh signed an important defence agreement to meet Bangladesh’s defence requirements. The agreement was perceived as an insurance policy for Bangladesh in the India-specific context. It
was also well understood that China would get a strategic foothold on India’s Eastern Edge in Bangladesh (Kapila, 2003). According to a report submitted by China to the UN Arms Transfer Register (for the first time in nearly ten years) in 2007, China appeared to have made substantial arms supplies to Bangladesh making Bangladesh that year the prime purchaser of weapons made in China. These included, 65 large calibre artillery systems, 16 combat aircraft, and 114 missile and related equipment, (Samantha, 2007). In March 2006, China donated police equipment to Bangladesh as part of the cooperative effort between the Home Affairs Ministry of Bangladesh and the Public Security Ministry of China. China also sold 16 F-7 BG fighter planes to Bangladesh. Chinese origin military hardware in Bangladesh include T-59, T-62, T-69 and T-79, armoured personnel carriers (APCs), artillery pieces, small arms and personal weapons. Bangladesh also acquired 155mm PLZ-45/Type-88 (including the transfer of technology) and 122mm Type-96 as well as MBRLS from China (Rao, 2010). However, according to analyst Arnold Zeitlin (2005) “It is common knowledge among diplomatic circles in Dhaka that the army is not happy with the quality of Chinese arms and it is equally well known that it cannot find other goods as cheap as from China. Bangladesh has turned to China almost out of necessity and China is happy to respond and reassert its strategic presence in South Asia.

Bangladesh Navy also keep wide-ranging Chinese wares. These includes Chinese 053-H1 Jianghu I class frigates with 4x HY2 missiles, Huang Feng Class missile boats, Type-024 missile boats, Huchuan and P-4 class torpedo boats, Hainan class sub chasers, Shanghai class gun boats and Yuchin class LCUs (Rao, 2010). China is helping Bangladesh to develop deep-water ports at Sonadia Islands funding 99% of the project and Chittagong port. Bangladesh set up a missile launch pad near the Chittagong Port with assistance from China, where initial test flight was carried out on May 12, 2008, with the collaboration of Chinese experts. Land attack anti-ship cruise missile C-802A was test-fired shortly afterwards from the frigate, BNS Osman near Kutubdia island in the Bay of Bengal. In Nov. 2016, China also provided type 035G class submarines to Bangladesh for US$ 203 million (ecan Chronicle, 2016). In March 2014, two new navy frigates – Abu Bakar and Ali Haider were commissioned from China. Bangladesh acquired two diesel-electric submarines from China on November 14, 2016. After their entry into the service in 2017, they will become the first and only submarines in the Bangladeshi navy (Sputnik News, 2016). Bangladesh is being highly valued by China for its vast natural gas reserves which can be accessible to China through Myanmar with the help of pipelines. China has been granted exploration rights by Bangladesh for developing its natural gas fields at Barakpuria, which contain about 390 million tonnes over an area of 6.69 square kilometres (Niazi, 2006). In December 2011, local and Chinese joint venture firm Orion-Long King got the contract from Bangladeshi government to build three coal-fired power plants that will generate a total of 1,087.34 MW of electricity. The consortium will build one 522 MW coal-fired power plant at Mawa in Munshiganj, and two others in Chittagong and Khulna with a generation capacity of 282.67 MW each (Misa, 2012).

Chinese intentions and engagement with Bangladesh depict its valuable strategic position. China grabbed the opportunity as Bangladesh became conscious of security threats like piracy, natural disasters and felt the need to develop the infrastructure for which China happily consented and entered in addition to other spheres, the maritime sphere of Bay of Bengal by taking modernisation work of Chittagong port. Bangladesh is benefitted as her 80% imports come through this port, and China’s benefit lies in gaining access to IOR and to counter the growing Indian and US influence in this region. Further, the ramifications of China’s engagement
could be judged from the fact that in the event of a major Sino-Indian military conflict, China from Tibetan Chambi Valley could sever off the narrow Siliguri Corridor, which separates Nepal from Bangladesh only by a few miles. The fall of this vital Indian land Corridor could totally cut off India’s resentful eastern states from the rest of the world. It thus seems natural that China would be interested in maintaining close relations with Bangladesh, keeping in mind its record of antagonism with India. In fact, this strategic reason was one of the primary reasons, why China developed a long-standing partnership with Pakistan. While Sino-Indian relations are much friendlier than before, relations between the two neighbouring giants are likely to remain antagonistic in nature because of the outstanding unresolved bilateral issues. This reality creates an opportunity for both these countries to develop a strategic partnership and take the relationship to a new height.

China Outfoxing India from Nepal

China’s engagement in Nepal takes a variety of forms: economic investment, trade, aid, infrastructural development, military assistance, diplomatic exchanges, as well as cultural and educational initiatives. China’s strategic objectives in Nepal include to neutralise and eliminate Indian influence, secure China’s borders by ensuring that the Tibetan refugee population is effectively restricted, and recover what it considers as one of its lost territories seized by imperialists. The Tibet factor is the foremost cause of interest of China in Nepal. In the beginning, the diplomatic relations between the two moved with great stability and speed. In the first phase (1955 to 1989) of the relations, China’s motive was to create infrastructure in Nepal and to protect its territory from any other country. At the first anniversary of Kathmandu-Lhasa road agreement, in October 1962, Chinese foreign minister Chen Yi said, “I assure His Majesty, King Mahendra, His Majesty Government and the Nepalese people, that in any case, any foreign forces attack Nepal, we Chinese people will stand on your side (Muni, 1989).

China has also dramatically increased its aid to Nepal in recent years. Based on official Government of Nepal (GoN) statistics, Chinese aid to Nepal increased from 10 million Nepal Rupees (NR) (US$128,200) in fiscal year 2005/6 to NR 2.55 billion (US$32.5 million) in 2010/11 (Campbell, 2012). China had reportedly pledged loans and grants worth more than NR 10 billion (US$127.4 million) by August 2011 (Ibid). It included a sizeable concessional loan of about 7 billion for the Trishuli hydro-power construction and US$19 million for assistance to the Nepal Army. When a high-ranking Chinese delegation visited Kathmandu in August 2011, they signed an additional US$50 million economic and technical co-operation agreement, including a loan for a hydropower transmission line and US$2.5 million to strengthen the capacities of the Nepal Police (Ibid). China now reportedly figures in the list of Nepal’s top five development partners.

In June 1984, it agreed to build a second trans-Himalayan highway, linking the city of Pokhara with the Xinjiang-Tibet highway. China has already initiated the construction of a rail network connecting Tibetan capital of Lhasa with the market town of Khasa on the Sino-Nepal border and this 770 km projected Lhasa–Khasa rail link is an extension of the world’s highest railway, which runs between Goldmund, a city in China’s Qinghai province and Lhasa. This is an immensely costly (US$1.9 billion) and long-term project. The project was planned to be completed by 2013, and is expected to follow Lhasa- Kathmandu Friendship Highway route. The Chinese scheme of proposed rail link aimed at improving its transport infrastructure in the isolated Himalayan region and is likely to strengthen Nepal's strategic and economic engagement with China and reduce its dependence on old traditional friend India (Ramachandran, 2008). Chinese plans are not limited to railways

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but include the plans for six additional highways to link up with Nepal, the development of cross-border energy pipelines and optical fibre. There is another Chinese proposal too to extend the Goldmund-Lhasa line to Nyingchi, an important trading town north of the Indian state of Arunachal Pradesh, at the tri-junction with Myanmar. From Nyingchi this rail link is further scheduled to link up to Dali in Yunnan province. Extension of this rail link up to Dali will complete the circuit of the Chinese national rail network. Moreover, connecting it up to the existing western railway network will grant strategic as well as economic benefits to China. From Chinese Military point of view, this Lhasa- Nyingchi-Dali route is significant as it runs in an east-west direction almost parallel and quite close to the Arunachal border, means quick and easier deployment of the military along the Sino-Indian border (Arya, 2008). Besides the construction of the railway connecting Lhasa to the Nepali border, China is involved in several other major transport projects in Nepal, such as the expansion of the Kathmandu ring road and the development of a dry port at Tatopani near the border with Tibet (Regmi, 2010).

In September 2008, China invited the Nepalese defence minister Ram Bahadur Thapa as an observer to the military exercise ‘Warrior 2008’, and during his meeting with China’s defence minister Liang Guanglie, China announced a military aid package of $1.3 million to Nepal (Kumar, 2011). In December 2008, Lieutenant General Ma Xiaotan of the PLA pledged $2.6 million in non-lethal military aid to Nepal during a visit. The visit of General Chen Bingde, Chief of General Staff of the PLA in March 2011, symbolised the growing relationship between the armies of China and Nepal. General Chen announced a military assistance package worth US$17 million from the PLA to the Nepalese Army, with assurances of more support to come. The Chief of Army Staff (CoAS) of Nepal also paid a visit to Beijing in November 2011. Initially an agreement worth US$7.7 million was signed between the two army chiefs (Pradhan, 2011).

China- A Reliable Partner of Sri Lanka

Chinese has been making efforts to build and enhance their strategic influence in Sri Lanka. China has emerged as the biggest donor of Sri Lanka. The Chinese assistance to Sri Lanka increased fivefold to nearly $1 billion, by overtaking Japan in 2009 (Kumar, 2009). China’s 2010 and 2011 annual investments were highest in Sri Lanka, where Chinese firms have completed, or are in the process of completing some large-scale projects. These projects span multiple sectors, including investments in transportation. Many large projects have been conducted in Hambantota, the home province of President Rajapaksa. These projects include a 35,000-seat cricket stadium, a large convention centre, a $209 million international airport, and a $1.4 billion deep seaport located on strategic sea-lanes (Brunjes et al., 2013).

China pledged to provide 85% of funding for the development of the first phase of Hambantota port in Sri Lanka where China is supposed to develop facilities like shipbuilding, bunkering, crew changing and ship repairing. This phase was completed in 2014. China also worked on a 610m oil dock, dredging of a 210m wide entrance channel, two breakwaters, excavation of 17m deep basin area, a 600m turning circle, a 600m general purpose berth, a 105m service berth, and roads and associated buildings. There were negotiations to accelerate the work on the second phase which costs $750 million. Once the three-phase project is completed, it will become the biggest port on South Asia with 4,000 acres of service that can accommodate 33 vessels at a time (Adaderana News, 2016). In March, 2016, the two countries announced the resumption of a 575-acre controversial project worth US$1.4 billion project, the Colombo Port City, that was suspended over the issue of irregularities in the contract arranged by Sri Lanka’s previous administration (Watson, 2016).
Over the years, the Chinese presence in Sri Lanka has increased so much so that there is no major infrastructure project in which the Chinese have not invested. It is estimated that China was Sri Lanka’s biggest source of foreign funding in 2009, providing $1.2 billion. (Das, 2010). The projects in which China has invested include an oil-storage facility, a Mathala airport, Colombo South Harbour Expansion project, the Narochcholai coal-fired power plant and Katunayake-Colombo Expressway. It is also rebuilding the main roads in the war-shattered north and east, and constructing a modern performance arts centre. It has also sold diesel railway engines and earth moving equipment. China provided anti-aircraft guns, Type-85 heavy and Type-80 light machineguns, Jian-7 fighter jets, 152mm howitzer, Type-56 rifles, 81mm mortar shells, RPG-7 rockets and other required amounts of ammunition (Manoharan, 2014).

Chinese policies vis-a-vis Sri Lanka are part of its greater strategy for building an encircled network of road and port connections in India’s neighbourhood, in order to strategically create dominance over the IOR. The threat perceptions among Indian circles have grown in view of China’s more active involvement in South Asia especially the construction of Sri Lanka’s southern port (Hambantota) which India fears that China will use it against India. India is worried that Sri Lanka is maintaining close links with China. The matter of concern for India is that there is the possibility of adual-use of these infrastructure projects. For instance, China is allowed to have storage and fuelling facilities at Hambantota, although India has also been offered to enjoy the same facilities. Similarly, the Colombo port that handles about 70 percent of India’s shipping is being modernised with Chinese assistance. So there are possibilities that China in future can turn these projects to India’s disadvantage in a conflict situation.

### China’s Footsteps in Maldives

As Maldives is strategically located southwest of India across major sea-lanes in Indian Ocean Region, India’s concerns appeared with regard to Maldives when in 2011, China established its embassy there. According to Indian officials, Beijing has stepped up its plans to secure some more crucial development projects in the island nation which has some 1190 islands located there. Indian policy analysts invented and implemented the term “creeping expansionism” which refers to China’s soft power rise throughout South Asia.

Trade between the two countries has gradually increased. In 2002, Sino-Maldives trade volume reached $US2.977 million, out of which China’s exports accounted for $US2.975 million and imports $US2000 (China Daily, 2009). In 2010, bilateral trade between the two countries reached $US64 million, which is 56 percent increase from 2009.

China has actively participated in the Maldives infrastructure construction and other projects. On September 2, 2012, three agreements were signed between the two Governments providing for Chinese assistance worth US $ 500 million (Raman, 2012). In 2013, the Chinese government provided 50 million Yuan (US$8.2 million) in grant aid to the Maldives government for the execution of developmental projects and the improvement of public services. (Robinson, 2013).

China is boosting its domestic companies to contribute to infrastructure building in the island state by means of offering preferential loans. In 2012, Maldives Defense Minister requested to China for a soft loan of Rs 250 crore for an IT infrastructure project. This does not came as a surprise for India because Maldives-China tie-up had been observed earlier also when Chinese companies signed two MoUs in mid-2011. The MoUs were signed...
between the Huawei Technologies (Lanka) Co. Ltd of China and the National Centre for Information Technologies, Maldives, to develop the IT Infrastructure in Maldives under the 'Smart Maldives Project (Joshi, 2013). Commenting on such a development, the Research and Analysis Wing (RAW) (2012) has alerted that China can use listening devices to monitor/intercept any communication carried between India-Nepal and India-Maldives.

China has expressed its desire in developing the islands of Ihavandhoo and Maarandhoo with transshipment ports. China wants a presence in these islands since they are the closest to India and Sri Lanka. The security agencies here have repeatedly been saying that the 'Marao Island' which was leased by Maldives to China in 1999 for maritime traffic management was also being used by the Chinese to monitor Indian and US warships in the Indian Ocean, and in future could be developed into a submarine base. China's main aim is to ensure the security of its sea-lanes facilitating its critically-needed energy imports. But the fact can’t be denied that it also amounts to a virtual encircling of India, in what is called the "string-of-pearls" strategy (Pandit, 2011).

Maldives signed a military aid agreement with China when Defence Minister Mohamed Nazim visited China on December 10, 2012. Nazim held talks with his Chinese counterpart which focused on Chinese military assistance to developing the Maldivian military. The agreement to mature military ties and provide free Chinese aid to the Maldives National Defence Force (MNDF) was signed at the meeting. Maldives National Defence Force (MNDF) has revealed that the military agreement signed between the two would yield USD3.2 million in free aid. Defence Minister Nazim also met the Vice Chairman of the Chinese Central Military Commission, Xu Qiliang, and discussed solidification of Sino-Maldives military ties (Naish, 2012). The visit was followed by the abrupt termination of a 25-year concession agreement with Indian infrastructure giant GMR to modernise and manage the Ibrahim Nasir International Airport (INIA). The Indian media blamed for Chinese role in the government’s decision to void the agreement and evict the GMR-led consortium. No doubt, the Maldives has ruled out any foreign hand in the entire airport mess but Waheed’s coalition partner, the Adhaalath Party had stated that Maldives would rather give the airport contract to their friend, China. China already having a base in the Seychelles and growing proximity with Maldives would be a severe blow to ultimate Indian power in the region. According to one Minister of Economic Development Mohamed Saeed, investment from China will help to increase the passenger handling capacity of the Airport and the construction of a second runway.

Both the countries presidents exchanged visits in 2014 and committed themselves to construct the 21st century Maritime Silk Road (MSR) thus to benefit both the countries and their peoples. The visit by Xi Jinping resulted in signing the agreements like MoU on promoting Male-Hulhule bridge project construction, MoU on health cooperation, MoU on Foreign Ministries Cooperation, Agreement on Establishing JCTEC (Fukang, 2015).

India's Geo-political Outfoxing: South Asia as a Concern

The strategic proximity to China with India’s neighbours has increased particularly after the Sino-Indian war of 1962. China’s every move to consolidate its position in South Asia has created concerns among Indian circles and India should worry now if we check the recent developments of China in India’s neighbourhood. The biggest, prime and grave concern lies in the fact that support of China to Pakistan is unfathomable. As the
history of Indo-Pakistan relations is known to the whole world being fractured, full of suspicion and antagonism, war fearing atmosphere and mistrust. The recovery and relief of relationships seems a distant reality and even unimaginable. Trade relations are peak lower than rest of the neighbours, diplomatic fields deserted and defence engagement not even in fractions.

Analysis of China’s involvement in Pakistan shows that there is hardly any field where China is not fashioning Pakistan-all to the discomfort of India. Transfer of sophisticated military equipment, nuclear technology, strategic infrastructural projects like $46 billion China-Pakistan Economic Corridor, and the much debated Gwadar port which has recently started operations with Chinese ships docking at Gwadar to carry the first containers brought by a Chinese trade convoy from Xinjiang for despatch to the world market in Nov. 2016. The Port of Gwadar will serve both Geo-economic and geostrategic purpose for Pakistan and China. On the one hand, both countries will reap the benefits of trade with other nations, and on the contrary, there may be the creation of some 70 lac jobs, and more particularly, the naval capability of Pakistan will be boosted. For China the job is now quite easy to station its naval forces on the port means a greater degree of China’s presence in the Indian Ocean as was predicted by India’s security analysts from time to time. Bhadrakumar (2016), argues that reports from Pakistani officials surfaced that China proposes to deploy its naval ships in coordination with the Pakistan Navy to safeguard Gwadar port. So the kind of fear factor predicted by India’s analysts about China’s involvement in the project has now taken a concrete shape. Moreover, the CPEC project is highly significant for Beijing because it will help China to carry the oil supplies arriving from the Persian Gulf to the port of Gwadar and channel it through the pipelines to western China. Accordingly, with a transport route some 6,000 miles shorter, China will be able to save billions in terms of transportation costs and time.

Some of the infrastructure of CPEC passes through the Pakistan Administered Kashmir, a territory which India claims from Pakistan. These developments further complicate the things for India. The situation further looks gruesome as Pakistan recently approved Russia’s request to use Gwadar port as per the desire shown by Russia who wanted to be part of CPEC. This means the ties between the three countries would be strengthened significantly. Not to stop here, Iran’s President Hassan Rouhani in a meeting with Prime Minister Nawaz Sharif on the side-lines of the UNGA also expressed a desire to be part of the China-Pakistan Economic Corridor (CPEC) as both leaders expressed satisfaction over the positive trajectory in Pak-Iran bilateral ties. Here arises another distress for India as its intended investments in developing the port of Chabahar to neutralise China’s Gwadar presence seems to be losing credibility given the Iran’s decision to keep Chabahar open for Pakistan and any other regional country.

Bangladesh is the next hot spot of concern where China is gradually replacing India in almost every dimension ranging from strategic to commercial, from energy security to infrastructural. Let us take the case of trade relations. Statistical data of 2013-14 shows the bilateral trade volume between India and Bangladesh stood at USD 6.6 billion (Yadav. et,al, 2016). While as it stood at a record high of USD 10.3 billion between China and Bangladesh with a growth rate of 21.9 per cent in 2012, ten times that of 2002 (Wahid, 2015). Since 1991, India’s exports declined continuously, which stood at 150% more than China in 1991 but fell 30% by 2010 (Sahoo, 2011).
No doubt India still leads the ground in Bangladesh, but China is chasing the target very swiftly. One recent move of China is the visit of Xi Jinping to Bangladesh in October 2016. According to Paul and Blanchard, in response to India’s $2 billion credit line during a visit of Narendra Modi to Dhaka, China this year (2016) signed off loans worth over $24 billion (2016). The recent sale of Submarines by China to Bangladesh has alerted Indian establishments. Admiral Prakash of Indian Navy stated that, the sale is a step in a long-standing Chinese policy of encircling India with client states who are dependent on China (Gupta, 2013). According to Khurana (2016), India Navy Captain and Executive Director at Indian Maritime Foundation, "Beijing's overarching intent behind the sale of submarines would be to go beyond strengthening political ties with Dhaka. The long-term submarine training and maintenance needs of the Bangladesh Navy would also enable China's military presence in the Bay of Bengal, and enable it to collate sensitive data for PLA Navy's submarine operations in the future. Another critical factor which irks India is the China’s securing of exploration rights in Barakpuria coal mines and approval to develop Port facilities at SONADIA Islands which is directly linked to China’s grand strategy for the Indian Ocean.

The first phase of the SONADIA Islands deep water port project was completed in 2015 with 99% of funding by China. China believes that this will serve as another Gwadar by having access to Bay of Bengal giving high voltage headache to Indian defence establishment. Strategically, Bay of Bengal is ideal for India to choose for a second strike capability which is the characteristic part of India’s strategic-military doctrine that will ensure the best assurance for retaliation. But on the other hand, If China’s SONADIA Islands plan succeeds then, India will have to recount and realign its strategic plans and readjust its naval deployment pattern in the whole of Bay of Bengal. For Bay of Bengal emergency, China has already opted for development of Chittagong Port.

The relations between India and Sri Lanka are much better on most of the fronts, but China is slowly making its way deeper. There is no doubt that India has emerged the largest trading partner of Sri Lanka and leads with a significant margin but the gap is gradually shrinking. China has also bagged a leading role on many fronts as FDI, aid donations, and fast implementation of infrastructure projects. India’s trade with Sri Lanka totalled US $ 4.6 billion in 2014, while China’s total bilateral trade crossed $4 billion in 2015. This means that the gap is near to disappear in the future if China maintains the same pace. Further, By 2014, Chinese FDI in Sri Lanka was estimated at a whopping 405 million USD, while the Indian contribution was a scanty 4.3 million USD. Chinese aid donations in Sri Lanka also far exceed than India which stood at $308.92 million against India’s $142.85 million. The most alarming for India are the Chinese projects- the port in Hambantota at Sri Lanka's southern tip, built at the cost of around $360 million, with 85 percent funding from China's Export-Import Bank and a $1.4 billion port city in Colombo, initiated in 2014.

India is deeply resenting the close ties between China and Sri Lanka. Sri Lanka’s support towards China’s maritime silk route initiative has been seen as a threat to India’s strategic interest in the Indian Ocean and an attempt to encircle India. The fact is that India has not enough resources to compete China though India has a strategic edge over China in Sri Lanka because of its geographical proximity, cultural and historical linkages, and people-to-people contact. India has failed to exploit these opportunities to its advantage and the projects undertaken by India does not match the speed of implementation as that of China. Sri Lanka’s leaning towards China can also be judged from the fact that it is going through an economic crisis for which it cannot ignore the lucrative packages of China.
Despite India’s wide-ranging engagement with Nepal, the Chinese involvement in Nepal is focused, security oriented and based on the design of balancing. China’s core interest in Nepal has been manifold which include to restrain any anti-China activities by the Tibetan refugees present in Nepal and to increase its influence in the India–Nepal border and the Terai region, to end Nepal’s overdependence on India and to weaken India’s hold on Nepal. Noteworthy developments in China come along the border with Nepal, China and India. China’s road and rail network in Tibet inches towards the disputed Sino-Indian border. The Golmud-Lhasa railway line was inaugurated in 2006, and is being extended to Xigaze, and also to Yatung, a trading centre that is just a few kilometres from Nathu La (Arya, 2008). China concluded a 253-km long railway line extending the Lhasa line to Xigaze, a city of Tibet which is closer to the Nepalese border. China is planning to build a tunnel under Mount Everest, called Qomolangma in Tibetan, as part of its plan to extend its rail link to Nepal. The Nepal rail project from Lhasa to Nyingchithat is scheduled to be completed by 2020 will reach the Indian border. In May 2016, alarm bells ringed in Indian establishment when a freight train from China with 86 cargo containers left for Nepal. According to Indian observers, the freight train is another manifestation of China’s play game with the government of Nepal against India. In May 2015, the Chinese government published a White Paper on Defence, putting forward new objectives for the People’s Liberation Army (PLA). About strategy, it illustrated the Chinese military’s missions and strategic tasks in the new era. The Global Times in this regard announced in 2016 that, the status of the Tibet Military Command (TMC) facing India from Arunachal Pradesh to Ladakh was to be raised. Zhongping, a Beijing-based military expert, told Global Times that the TMC has great responsibility to prepare for likely conflicts between China and India because currently, it’s hard to secure all the military resources they need. All these projects have serious strategic implications for India, as the infrastructure built on the Tibetan plateau has a dual purpose to serve both civilian and military purpose.

India’s planning of repairing damaged border roads and to construct new roads and railway lines are running behind schedule for completion. Some infrastructure projects are not only missing completion deadlines but also failing to move beyond the paper work. Rajagopalan, observes a stark difference in infrastructure on both the sides of India and China. He pointed some tremendous improvements made by China over the past decade in connecting the LAC to the rest of the country. He observes that Tibet has a 40,000 km road network that run up to the LAC, unlike roads on the Indian side, which stop 60 to 80 km short of the border (Ramachandran, 2014). Former Indian foreign secretary and ambassador to Nepal Saran argues that instead of repeating the alarmist “Chinese are coming” refrain, India should act pragmatically as to how it can “consolidate” its geographical advantage. The Indian should respond with the border infrastructure much more seriously against the Chinese expansion (Kumar, 2016). Lama, a professor at Jawaharlal Nehru University (JNU), noted that New Delhi changed its mindset towards developing neglected border regions only around 2005. Since then, the pace of development is disturbingly slow and acutely dangerous for the country. Also, India’s economic blockade in response to force adomestic political change in Nepal is likely to hurt India’s long-term goals, as it forces Kathmandu to reassess and rethink its overdependence on India. The reaction of Nepal to India’s attempt to force constitutional reforms in Nepal will bring a shift towards Beijing and away from Delhi as China enjoys a reputation for non-interference in internal affairs of a country. India has almost opened up a space for China by the unnecessary act of economic blockade to Nepal which China can also highlight as an act of aggression in the whole of South Asia to diminish the image of India.
China’s engagement with Maldives is directly linked to its Indian Ocean strategy where China wants to secure its energy import routes and to further solidify its presence in India’s backyard. India has turned uneasy with the growing relations between the two countries. While India still leads the trade volume figure with Maldives that stood at US$ 125.4 million in 2013-14 which more than China’s trade figures that stood at more than US$100 million in 2014. The inclusion of Maldives as part of China's Silk Road project, and China’s infrastructure developmental projects like the Thavandhoo and Maarrandho Islands, with transhipment ports, bridge connecting Male to Hulhule—the island where the Male International Airport is located, Termination of the contract of modernisation of the Ibrahim Nasir International Airport with Indian company and its subsequent approval to China, are considered as alarming by the Indian establishments. Further, investment at mass scale means that China is legitimising its effort to maintain a military presence in this region. India in such a situation needs to expedite its efforts to increase cooperation with this nation and maintain a balance.

Conclusions

The investigation amply proves that South Asia’s Strategic importance is continuously growing in China’s strategic calculus and is penetrating deeper with all-out efforts to achieve its critical objectives. India’s strategic position and power potential to dominate the sub-continent have immensely influenced China’s policy projections towards South Asia. There has emerged a fierce competition between India and China in the region to achieve a dominant and influential status with one overtaking other and vice versa. Both are heavily involved in making large investments and building infrastructure in the South Asian countries. Both the countries are proactive in grabbing the opportunities to establish a benign image in the region. China has undoubtedly got the upper hand as compared to India as far as strategic competition with South Asian countries is concerned especially in grabbing the strategic projects development, heavy hand in aid and investments, defence deals and other supplies. This became solely possible because India’s disputes with its neighbours and their negative perception with regard to India. So China remains an easy option for India’s neighbours to play its card against India and balance the threat perception which they feel from India and its status in the region. Further, China is preferred over India because it has reputation of non-interference in internal affairs of other countries. Also, China’s economic strength and lucrative packages that too with soft conditions attached, has made it a favourable choice for India’s neighbours to stuck big deals whether in infrastructure development, aid, trade or investment. India itself played dull in dealings with its neighbours that provided the enough space for China to play against India. The current situation demands India to work thoughtfully and judiciously in her policies towards neighbours to consolidate her position that India desires in the region.

References


Kumar, A. (2009). China’s Island Strategy in the Indian Ocean: Breaching India’s Sphere of Influence. *Analysis (ORF).*


Impact of Misstatement in Financial Statements on Investment Decision Making

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Abstract- Financial statements are prepared with the view that they will be a representation of transactions entered into by a firm in a financial year. These financial statements are examined by public accountants to certify that they show a true and fair; but it has been observed that despite this measure, there exist some misstatements, fraudulently or otherwise in the statements. These misstatements occur in areas where the accountant is at freedom to use his opinion where alternatives existed. This is the concern of this research paper titled ‘Impacts of misstatements in financial statements on investment decision making. It is a descriptive study that is designed to examine misstatements in financial statements and how they are able to distort results of calculated ratios and their interpretations that most investment decisions are based upon. Three types of financial statements were considered and they are balance sheet, profit and loss account and cash flow, where most ratios are derived. Interviews and opinions of experts who have had practical experiences in industry as accountants and auditors guided the authors in their study. The study found out that there are several areas of a firm’s financial statements that are misstated, such as impairment of assets, inventories, receivables, accrued expenses, etc. Solvency is affected, liquidity is affected efficiency in assets utilization is affected, and also, profitability is affected. This is the reason investors should be aware that misstatements impact on ratios negatively, therefore should be more diligent in ratios analysis and interpretations. Auditors are not likely to uncover all the misstatements, hence investors may resort to other sources of information about a firm’s performance to complement ratio analysis.

Index Terms- Fraudulent misstatements, investment decision, financial statement frauds, impairment of assets, subjective opinion

I. INTRODUCTION

Financial statements are prepared by the accountant in an organisation to depict its financial results, financial position, and cash flows. The laws of most nations placed the responsibility of preparing financial statements in the domain of companies’ directors, and this is further delegated to the accountant. This culminates to preparation of some important reports as balance sheet, income statement, cash flow statement, and statement of retained earnings.

II. TYPES OF FINANCIAL STATEMENTS

There are different types of financial statements; statement of financial position (balance sheet), income statement (profit and loss account), cash flow statement, and statement of retained earnings. And these report or statements serve different purposes. Balance sheet. The balance sheet reveals the financial position or health of an organisation through a display of its assets and liabilities. The items here include share capital, reserves and surplus, long term borrowings, and current liabilities (liabilities); fixed assets, long term investments, current asset (assets). Income statement. The profit and loss account shows the operating results of the organization. Here is displayed the revenue, purchases, inventories, operating expenses, profits (losses) etc. Cash flow statement. The statement provides a summary of an organisation’s operating investment, and financing cash flows and reconciles them with its cash and marketable securities during the period. It gives an insight of sources of cash received and cash paid in a given period. Statement of retained earnings. It reconciles the net income earned during the year, and any cash dividend paid, with the change in retained earnings between the start and end of that year.

Investors, creditors, and other users of the financial statements have so much confidence in the contents of these statements, especially, when they are examined by auditors. But this confidence seems to be eroded by the nefarious activities of management to, in most cases, intentionally misrepresents the fact. This has led to varying degrees of frauds and misstatements in the financial statements.

The depth of this problem can be evaluated by the fact that on daily basis, there are reports of one kind of fraud or the other in financial statements of different companies globally. This has led to the collapse of manynational companies (MNCs), e.g., Enron, and the failure of corporate governance is at the heart of this misfortune.

The purpose of this paper is to spotlight common critical areas that misstatements occur in financial statements. It will also try in a modest way to advance reasons for such misstatements, whether they are deliberate or otherwise. And it shall consider the extent to which investors rely on the contents of financial statements for their investment decisions.

The most important functions of accounting entail that the accounting numbers should have the following qualities: Understandability, Relevance (materiality,& timeliness), Reliability, Completeness, and, Comparability.

This agrees with the provisions of the framework of the International Accountants Standards Boards (IASB: 2001).
With this achieved, it can fulfill the expectations of the different users, including investors. The standard practice all over the world is that practising accountants are appointed to examine the financial statements and attest whether they are true and fair in their report. This brings to mind the question of accuracy in the accounts, this to a large extent, is a matter of degree and interpretation. This means that 100% accuracy cannot be guaranteed. The auditors do what is statutorily possible to ensure accuracy, they can only achieve accuracy to the extent of their expert opinion. There is the view that accounting numbers are reliable because they are confirmed to be so by experts who take due care in the exercise of examination of the records. And to do otherwise means we are left to take our destiny in our own hands. The auditors observe due care because of the provision of prosecution in case of established negligence on their part. The financial statements need to be provided on timely basis for them to be useful.

III. REVIEW OF LITERATURE

We shall, under this section consider some past studies in relation to the topic. This will help in having better understanding on issue already in the public domain as revealed by these authors. The responsibility of preparing the financial statements is on the Board, whose duty it is to ensure that contents of the statements are reliable, true and fair. The International Federation of Accountants (IFAC:2002) also emphasizes this position.

Preparation of financial statements are done in India and other countries according to Generally Accepted Accounting Principles (GAAPs). The principles have the function of directing and guiding preparers of financial statements of how various items should be treated in the books so that the items will convey same meanings and understanding to different users who are financially literate.

Common misstatements in financial statements

The Association of Certified Fraud Examiners (ACFE) has made far reaching findings and report on financial misstatements and are disturbed because of the magnitude of the crime. The study of ACFE in 2012 reveals that those with higher level of authority tend to cause larger losses by fraudulent financial statements (ACFE Report 2012).

The Indian Accounting Standards (Ind AS) framework, paragraph 1.12 states that the objective of financial statements is to provide information about the financial position, performance and cash flows of an entity that is useful to a wide range of users in making economic decisions. And the International Accounting Standards 1:13 also reiterates that financial statements ‘shall present fairly the financial position, financial performance, and cash flow of an entity.

Rees (1995) opines that managers, in a bid to make their accounts look attractive, by judicious choice of accounting policies and applying bias where estimations are allowed. Rees(1995) also makes analysis of Smithand Hannah(1991) where the latter made a classification of common misstatements found in financial statements of entities into 11 groups:

1. Excessive provisions. Goodwill is overstated and not expensed, thereby increasing profits.
2. Extraordinary items. Significant reorganization/rationalization costs shoed as extraordinary items.
4. Capitalised costs. Inappropriate capitalisation to reduce costs.
5. Non-trading profits. Such profits as normal earnings figure.
7. Depreciation ratio change. Reduction in depreciatio9n policy to show growth.
8. Pension and holidays. Reduction in pension fund contribution shows larger pre-tax profits.
11. Low tax charge. If low tax charge appears, profit manipulation probable.

This study is actually very old that we may rightly say it is outdated, but the underlying findings appear to be as relevant today as they were when it was first carried out.

Horwitz, Kolodny(1981) wrote on ‘research and Development (financial statement capitalization)’ tested hypothesis of No decline on expenses. This hypothesis was rejected because there was a reduction in expenses as a result of capitalising R/D expenses which increased reported profits. This view is envisaged in IAS 38 in respect to intangible assets. This expensing of R/D is also discussed in Lev, Sarath, Sougiannis(2005), where question are asked about when principle of conservatism is followed or mere aggressiveness, since no procedure can be constantly and justifiably conservative or aggressive. Bias about R/D made PWC to issue industry alert to Pharmaceutical and Life Sciences Industry because of the complexity of funding and reporting R/D expenditures. On this note, Chhatwal(2014) studies the relationship between R/D and Sales and found out that R/D affects sales because of the uncertainty of how it will be treated in the books.

In the work of Gupta and Gill (2012), ‘Prevention and detection of financial statement fraud-An implementation of data mining framework’ a more scientific and computer based way to prevent and detect financial misstatements in the financial statements. They identified and collected 62 features from financial statements of 114 organizations; and found 35 informative variables by using one way ANOVA to identify ways to detect and prevent financial statements fraud.

Riedl. Srinivasa (2010) investigates the presentation of special items in the financial statements if they reflect economic performance or opportunism. Some of these special items are presented as separate lines in the income statement while others are merely shown as footnotes.

Feroz et al (1992) did analysis of accounting misstatement according to (SEC) investigation and concludes that in most cases, trade receivables were major source of misstatements, followed by inventories, investments, and long-term assets.
Causes and reasons for misstatement of frauds in the financial statements

Frauds and misstatements in financial statements has led to collapse of many organizations, especially large corporations. This has made researchers to doubt the accounting numbers to certify the information needs of users. Even when these statements are examined by the auditor, who is generally believed to ensure accuracy, reliability, and conformity to Generally Accepted Accounting Principles (GAAPs).

There are a number of studies on causes and detection of frauds in financial statements, Gupta and Gill (2012), where data mining methods are used to detect and proffer solutions to financial statements frauds. Frauds in this regards has been severally defined. It is said to be coercion of people such that they will act against their own best interest. Fraud is an intentional act meant to induce another person to part with something of value, or to surrender a legal right. The Association of Certified Fraud Examiners (ACFE) defines financial frauds not as ethical or moral, but rather it is as something of value, or to surrender a legal right. The Association of Certified Fraud Examiners (ACFE) defines financial statements fraud as ‘The intentional, deliberate, misstatement, or omission of material facts, or accounting data which is misleading and, when considered with all the information made available, would cause the reader to change or alter his or her judgement or decision.’ And to make the situation worse, this financial statements frauds are committed by top level management, those having the responsibilities to prepare a fraud free statements.

According to Rezaee (2005), financial statements frauds involve the following:

I. Falsification, alteration, or manipulation of material financial records, supporting documents, or business transaction
II. Material intentional misstatements, omissions or misrepresentation of events, transactions, accounts, or other significant information from which financial statements are prepared
III. Deliberate misapplication, intentional misinterpretation, and wrongful execution of accounting standards, principles, policies, and methods used to measure, recognize, and report economic events and business transactions
IV. Intentional omissions and disclosures or presentation of inadequate disclosures regarding accounting standards, principles, practices, and related financial information
V. The use of aggressive accounting techniques through illegitimate earnings management
VI. Manipulation of accounting practices under the existing rules-based accounting standards which have become too detailed and too easy to circumvent and contain loopholes that allow companies to hide the economic substance of their performance.

Causes of financial statements frauds

The existence of corporate governance may not completely eliminate financial statements frauds because of other factors. In the opinion of Rezaee (2005), financial statements frauds has cost market participants, including, investors, and more than 500 billion dollars during the past several years. The paper shows that ‘cooking the books’ constitutes financial statements frauds which is a crime. He concludes that due to the complexity of the crime, detection and prevention should be intensified. Cressey (1986) classifies causes of financial statement as; opportunity, attitude or rationalization, and motive or pressure.

Opportunity is a situation that presents itself such that management has the chance to perform material misstatement in the financial statements; such as weak or lack of internal control, absence of proper audit committee, etc.

Rationalization being the ability to act in self-perceived moral or ethical values that should be accepted by others as most appropriate thing to do at the circumstances. Management may claim doing for the interest of shareholders.

Motive could be under pressure to commit financial statements fraud, this may be as a result of poor cash position, to please customers.

Methods used in presenting fraudulent financial statements

I. Overstatement of revenue by inflating sales
II. Understatement of expenses. This may be by capitalizing expenses
III. Overstatement of assets, by not booking down accounts receivables
IV. Understatement of liabilities
V. Improper use of reserves
VI. Mischaracterization as one-time expense
VII. Misapplication of accounting rules
VIII. misrepresentation

Do investors consider the possibility of financial statements fraud in an audit?

Publicly quoted corporations are required by law of different countries and international laws that the corporations are required to appoint auditor(s), to examine the accounts of the company and report whether the accounts show a true and fair view. The International Accounting Standards Board (IASB), Indian Accounting Standards (IndiAS), etc., reveal the same intent and purpose. The auditors exercise due care and plan their audit such that negligence is exhibited in course of their duty. Does this duty of care and diligence stop investors from considering the accounts numbers carefully, before making investment decisions?

The way investors perceive published accounts is shown by interests researchers have demonstrated to the study of value-relevance of financial statements. Francis and Schipper (1999), are concerned about the relevance of the accounting numbers and wrote on ‘Have financial statements lost their relevance? Piotroski (2000), in his popular article ‘Value investing’ also discussed this same issue; Hung (2001); Chen, Chen and Su (2001) etc., were interested on the value-relevance of financial statements. This is the reason it is believed among financial experts that proper handling of the accounting numbers enhances financial decision-making process (Zager and Zager: 2006), ibicioglo, Kocabiyik, and Dalger: 2010.

Analysis of financial statements

There are varied users of the financial statements; and their areas of concentration will differ depending on what they set their minds to achieve. These users include investors, creditors,
management, researchers, Tax Authorities, the general public, etc. They would generally do financial statements analysis, which involves ratio analysis. Ratios are calculated and analysed based on the accounting figures in the financial statements; and as examined by public (practising) accountant. The ratios are grouped into four main segments:

**Leverage or Solvency Ratios.**
- Debt to Assets = Total Debts/Total Assets
- Debt to Equity = Total Debts/Total Equity

**Activity or Efficiency Ratios.** Analyses efficiency in the use of firm’s assets.
- Inventory Turnover Ratio = Cost of Goods Sold/Average Inventory
- Receivables Turnover = Sales/Average Trade Receivables
- Payables Turnover = Purchases/Average Trade Payables
- Working Capital Turnover = Sales/Average Working Capital
- Fixed Asset Turnover = Sales/Average Fixed Assets
- Total Assets Turnover = Sales/Average Total Assets

**Liquidity Ratios.** Analyse ability to meet current obligations when due.
- Current Ratio = Current Assets/Current Liabilities
- Quick Ratio = Current Assets – Inventory/Current Liabilities
- Cash Ratio = (Current Assets - Inventory-Accounts)/Receivables/current Liabilities

**Profitability Ratios.**
- Gross Profit Margin = Gross Profit/Sales
- Profit (Net) Margin = Net Income/Sales
- Return on Assets = EBIT/Average Total Assets
- Return on Equity = Pre-Tax Income/Average Equity

**Other Valuation Ratios.**
- Earnings per Share (EPS)

IV. METHODOLOGY

This study is completely a descriptive one, as the authors are trying to x-ray fraudulent misstatement in the financial statements and ways to detect and prevent them.

Discussion

Financial statements users, especially investors and creditors, place much confidence on the reliability and correctness of the accounting numbers, to guide them in making investment and lending decisions. This is on the premise that the statements have been examined by certified public accountants; and this may be misleading as misstatements still find comfort zone in the financial statements. Fraudulent financial reporting is almost seen as part of reporting, especially the management fraud. Even the highly rated audit firms fall short of identifying all error and frauds in the books they audit. However, their diligence and compliance to generally accepted auditing standards reduces such misstatements. What should be done by users?

**Leverage ratios**—a careful analysis of leverage ratios will ultimately reveal a potential risk of insolvency of the firm. This category of ratio shows the level a firm has utilized outsiders’ fund to finance the capital or finance assets. A high leverage ratio, shows that more debt financing is adopted by the firm than owners’ fund. The danger here is that obligation to the providers of outsiders fund must be met, otherwise, it may lead to loss of credibility, and sometimes litigation. However, if the firm is an industry that requires heavy investment in equipment and research and development (R/D), then check the cash flow whether it is robust and consistent, so to be able to sort out these obligations of the outsiders. Moreover, industries that require regular upgrade of facilities need heavy investment in equipment and this cannot all be borne by owners, hence the necessity of debt financing in such industries. Such huge investment will spur up production, leading to more sales of modern products, and more income. To ascertain the impact of debt on profitability, interest coverage ratio is computed, which will show the extent to which earnings may fall without causing serious concern and embarrassment to the firm in terms of paying fixed interest charges. A high ratio indicates an excessive use of debt, therefore, a low ratio is desirable. And bearing in the nature of the industry. Management could misstate the financial statement by means of manipulating depreciation. Inventory, and other related items could influence earnings before interest and taxes.

**Liquidity ratios**—provide a quick test of the ability of a firm to settle its short term debts without undue stress. Items of inventory and receivables could be manipulated to appear as though the current assets are far ahead of current liabilities, portraying a sound liquidity position. A firm with low level of liquidity that is not supported with a robust cash flow is likely to have the threat of reneging on debt obligation or asking for understanding from its creditors, by renegotiating the payment schedule. A general low liquidity typified by low current ratio and low quick ratio is a danger signal of bankruptcy that should be avoided.

**Activity ratios**—is about the velocity at which inventory is sold and replenished and efficient utilization of assets and other resources to operate with minimum loss and high profitability. Misstatements that affect profitability are at the heart of every intent to present the financial statement better than what they are actually are. A comparison of the activity ratios over time will direct our minds to the level of efficiency. Wide gaps in-between years should be studied carefully to ensure that all is well. When there is continuous production activities, it will give rise to increase in sales and by extension revenue, an increase in revenue increases profit which is good for the business.

**Profitability ratios**—guides to determine whether the firm is doing well or not, and if the stockholders are benefitting from the profits generated by the firm by way of dividends payment. A firm seeking for credit could present an otherwise impressive statement to pave way for their loan request, or give impression.
of regular payment of dividends to convince investors to plunge into the murky water typified by ugly state of affairs in the company. High profitability ratios is an indication of good omen for the firm and the shareholders.

Specifically, areas where misstatement often occur are the following:

Impairment of Assets. IAS-36 as amended intends to ensure that assets are recorded in the books at values more than their recoverable values when sold or transferred. An impaired asset is a company’s asset that has a market value less than the amount stated in the books. The assets that affected are those that involve judgement to be exercised by preparers of the financial statements. They include: Goodwill, accounts receivables, and long-assets, because their carrying value has a longer period of time for impairment. Goodwill involves estimation of future cash flows that are generated from fixed assets or goodwill; and are done subjectively, not necessarily based on definite calculation or scientific reasoning. This is more obvious when determination of fair value is to be made. This is why it is prone to misstatement in the financial statements.

Another important asset that is affected in this issue of impairment is Work-in-progress. Timing of recognition of cost is a major problem in the construction industry, and it is often subject to fraud of misstatement in the financial statements. Some contracts take a very long time to completion, thereby involving high degree of estimation in completion rates at different stages of completion.

Inventory is among the assets subjected to different opinions on its valuation, there may be inadequate provisions for damages, obsolete inventory becoming obvious because of slow-moving stock. These may be misstated because the accountant applies opinion which is subjective. Inventory affects current ratio in determination of a firm’s liquidity and other ratios.

Receivables are easily misstated by making inadequate provisions for bad and doubtful debts. Some of these debts are left to be outstanding for too long that should be fully recoverable. This could be done to show better liquidity status of a firm. Here, the liquidity ratios are affected such that they may portray positive and comfortable liquidity position.

Sometimes, liabilities could be subject of misstatement in the financial statements. The item mostly misstated relates to accrued expenses as it concerns litigation, environmental issues, etc. When accrued expenses are not properly recognized at the end of a financial year, financial position will be affected. Profitability ratios will be affected, analysis and interpretation of vital indicators of the company might be misleading.

Preparers of financial statements will intentionally select an option that misstates the statements fraudulently with the leverage available to them to choose the method to use.

Investors rely on the auditor and thinks that financial statements could be relied upon for investment decision, having been examined by the auditor.

Assets are misstated than liabilities, but they both have negative impacts on investment decisions.

Most devastating misstatements are top management driven, and they are huge task to curtail since management is usually determined to defend its decision and actions.

VI. SUGGESTIONS

Users of financial statements, especially investors should be aware that the statements could be fraudulently misstated, to mislead users, hence, should look more carefully on the areas that prone to misstatements.

Auditors do not guarantee absolute accuracy and correctness of the accounts, but after careful planning execution of an audit express opinion on its truthfulness and fairness.

More studies should be done on how to reduce areas of misstatements in the financial statements.

REFERENCES

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The Use of Relative Clauses in Shaw’s *Major Barbara*: Implications of Teaching Grammar

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Abstract

This Study tries to shed some light on the usage of relative clause (subject, direct object and indirect object, object of preposition, possessive, and object of comparison, restrictive, non-restrictive, and reduced) as rich and complex syntactic in modern English Literature through the study of English play to know the most and least frequent types of relative clauses (RCs) used and to prove that modern English language attempts to use the easier type of relative clauses to combine sentence. The study investigates the frequency, categorization and percentage of each occurrence of relative clauses in George Bernard Shaw’s play *Major Barbara* written by George Bernard Shaw. There are some questions in the play: Is there a high frequency of relative clauses on the upper level hierarchy more frequent than the lower level? Is there a lower frequency of occurrence for relative clauses on the level of Keenan’s hierarchy? And in the light of Shaw’s play *Major Barbara* what are the implications of such analysis and in an EFL context? The results of the study in the play indicates that the subject relative clauses (RC) in the play occurred 118 times which (70.238%), direct object RC occurred (34) times which (20.833%), object of preposition RC occurred (5) times (2.971%), possessive RC occurred (6) times (3.571%) and object of
comparison didn’t occur at all (0%). This mean that the subject relative clauses and the
direct object are the dominant types of relative clauses respectively. This proves that the
subject relative clauses and the direct object RC are considered the upper level of hierarchy
and are more frequently used in the modern English Literature. The other kinds of the relative
clauses such as indirect object, object of preposition, possessive and object of comparison
are considered the lower level and are less frequently used in the modern English Literature.
Besides, the results indicate that the modern English play writing attempt to use the easier
types of relative clauses, the subject and the direct object to combine sentence.

**Key words:** direct object, indirect object, object of preposition, relative clauses, subject.

1- Introduction

The relative clause is a frequently used kind of subordination. English, especially written
English, uses subordination. Arabic on other hand, uses coordination (Khalil, 2000). The
relative clauses are an important and rich syntactic in English. Since no studies have been
conducted previously on the use of relative clauses, their frequency and their various kinds in
English literature, this study sheds light on this area of research.

Relative clauses constitute a problematic area for Arab EFL learners as they are rich
syntactic structure in English and they can hinder effective communication because they are
semantically and syntactically complex. This study tackles the usage of relative clauses in
modern English literature through discourse analysis of a modern English namely Major Barbara by George Bernard Shaw and to prove that modern language attempts to use the easier types of relative clauses to sentence to combine sentences relative clauses are categorized into nine categories: Subject (SU) relative clauses, divided object (DO), indirect object (IO), object of preposition (OP), genitive, object of comparison, restriction, nonrestrictive and reduced contact clauses, each of which has a level of difficulty. It is assumed that the easier construction (formation) is more frequently used.

2-Problem

Relative clauses especially those on the lower level of Keenan and Comrie’s (1977) hierarchy constitute learning difficulties. No study has attempted to elaborate the occurrence and frequently of these difficult structures in extended discourse like that of a play.

3-Aims

This study has the following aims:

1-Examining the frequently and categorization of relative clauses in a modern English play, namely Major Barbara

2-Shedding light on the most and the least frequent types of relative clause used, and proving that there is a lower frequency of occurrence for relative clauses on the lower level of Keenan’s Hierarchy while the relative clauses on the upper level hierarchy are move frequent than those on the lower one.
3-Investigations the impact of such analysis and categorization on the practice of teaching grammar in EFL contact.

4- Definitions

Relative clauses are dependent clauses that modify nouns.

They are introduced by a set of relative pronouns (that, which, who, whom, and whose). They are called adjective clauses because they have the same function as adjectives but they come after the head noun as post nominal modifiers (Crown, 2008:420). Kharma and Bakir (2003:332) and Jacob (1995:367) define the relative clauses as a sentence like construction that the head noun and provides information about the set of entities denoted by the head noun, e.g., the meteor that she saw was quite large.

Crown (2008, P: 420-421) said that the relative clauses are dependent clauses that modify nouns. They are introduced by a set of relative pronouns: that, which, who, whom, and whose. They are called adjective clauses because they have the same function as adjectives but they come after the head noun (post nominal modifiers). Besides, relative clauses are formed by means of wh-movement.

"this rule move the NP in the relative clauses that corresponds to the noun phrase in the main clause to the front of the relative clauses, leaving a gap at the place from which it was
moved. The NP formed by wh-movement is replaced by a relative pronoun " e.g. The movie (that we saw the movie) was really scary. (Crown, 2008:421).

English relative clauses can be classified into six types of restrictive clauses as follows: subject relative clauses, direct object relative clauses (DO), Crown (2008:421), Quirk (1985:1248) and Quirk (1973:356) pointed out that English relative clauses can be classified into restrictive and non-restrictive depending on the function of the relative pronoun as subject, object, complement or prepositional complement. A restrictive relative clause is a clause that restricts the reference of the noun phrase modified and adds necessary information to it. For example, my brother “who live in Herbron, is a teacher. But a non – restrictive relative clause is a clause that doesn’t restrict the noun’s reference and it adds additional and unnecessary information about the modified noun (the head noun).

It is indicated by the commas around it. For example, the pretty girl, who is a typist, is Mary Smith.

Keenan and Comrie’s (1972:81) stated that languages differ in the formation of their relative clause on the basis of three dimensions. The differences among languages with respect to the distraction relative clause cause problems for ESL and EFL learners. The three dimensions are: -

1- The position of the relative clauses with respect to the head noun.
2-How relative clause are marked.

3-The presence or the absence of a pronominal reflex.

Keenan and Comrie’s (1977: 81) suggest a theoretical model known as noun phrase Accessibility Hierarchy (NPAH). There model showed that the higher positions on the hierarchy are easier to be relativized than the lower ones. Below are six position of the hierarchy model: subject NP, objet NP, indirect object NP, oblique object NP, genitive NP, and object NP of a comparison. Their hierarchy state that in universal grammar, subject NPs are easier to relativize than indirect object NPs, ... etc. The most difficult position is the object of a comparison and it is rather rarely used.

Concerning the characteristics of relative clauses, Quirk (1983:315) stated that relative pronoun is capable of showing concord with its antecedent and indicating its function with the relative clauses as a constituted of an element of clauses structure (S, O, C, A). This mean that the relative pronoun function respectively as subject, object, complement and adverbial (including its role as prepositional complement) in the relative clause with personal and non- personal antecedents e.g.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Who spoke to him...</td>
<td>Subject</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Who(m) he met ......</td>
<td>object</td>
</tr>
<tr>
<td>The person</td>
<td>Who(m) he spoke to …… prepositional complement</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>To whom he spoke …. Prepositional complement</td>
</tr>
<tr>
<td></td>
<td>Toward whom the dog ran …… (adverbial )</td>
</tr>
<tr>
<td></td>
<td>Whom the dog ran toward …… ( adverbial )</td>
</tr>
</tbody>
</table>

The relative clauses modified the NP (noun phrase) of the base string forming with it an expanded noun phrase which can then occur in any function in a matrix string in which the original noun phrase could occur.

The words *who, when, whose which, and that* are called relative clause: *who* (subject and whom (object) are used when the NP refers to people, *which* is used for things, *whose* is used for possession and that can be used for all NPs and it can be used for things and people as subject and object in defining relative clause. This mean *that* can be used for instead of who(m) and which in defining relative clause (Robert, 1964: 206-214).

5-Litraure Review about the Problems in Relative Clauses Encountered by Arab Learners

Tushyeh (1985) stated that adult EFL learners encounter problems in the production of relative clauses and make errors in using them. He found that language transfer is an important factor in the acquisition of relative clauses by adult EFL learners.
Kharma (1987) conducted a study about the difficulties encountered by Arab learners in the formation of relative clauses. The collected data from the free essay writing of university students, from Arabic to English translation and multiple choice tests in addition to multiple choice test at the secondary school level.

Then, he collected the student errors to arrive at the source of errors. He found that all the persistent errors and all errors types can be ascribed to the negative transfer (or interference) from Arabic. Another point is that all errors made in the formation of relative clauses are errors of form not use and they do not affect communication.

Tadros (1979) found that Arab speaking students at Khartoum university made errors in forming relative clauses in English. He analyzed interference errors in the written English of students through his study that involves 472 scripts obtain from 236 students at Khartoum university. These errors are attributed to interference from Arabic.

Khalil (1985) in his article “Interlingual and Interlingual Errors in Arab Freshman English” explained that Arab learners commit errors in forming relative clauses. He collected data from 150 final examination composition papers written by Arab learners enrolled in the first semester as freshman students taking the English courses 103 and 104 at Bethlehem university. He identified sense types of errors: The copula, embedded questions, pronoun retention, prepositions articles, semantic, and stylistic errors.
Shachter (1974) collected data from free compositions written by Arab, Chinese, Persian and Japanese EFL learners. She gathered all the relative clauses from three compositions and analyzed them in respect of the three dimensions of Keenan and Comrie (1972). She found that Arab and Persian learners and the Chinese learners find relative clauses formation in English similar to their native language forms to English and produced more relative clauses. Khalil (2000: 109-113) classified the errors committed by Arab EFL learners in the use of relative clauses into nine types: relative pronoun omission, relative personal pronoun miss election, subject retention, object pronoun retention, whose miss election, who–which, miss election, who miss election and wrong number concord. He attributed most of these errors to Arabic interference.

Besides, he attributed other errors such as who–whom miss election to errors induced by the teacher situation. When teacher tell their learners that who and whom have the same meaning, they overgeneralize this rule and use who or whom in the wrong linguistic context. Crown (2008:440:442) stated that EFL students make errors in producing English relative clauses in their L1s differs from that of English. For example, the beginning of the relative clauses in language such as, Arabic, Turkish and Farsi in marked by a single subordinator. Subject and object presumptive pronouns are considered persistent transfer errors made by EFL learners. For example, *I has learned that I shouldn’t do things that (they) hurt them.
The man who we saw (him) yesterday is my father.

6- Problems that Arab EFL Learners Have with Relative Clauses.

According to the empirical studies conducted by Khalil (2000), Tushyeh (1983), Tardose (1974) and Shachter (1974), the most common errors committed by Arab EFL learners are:

1. The Repetition of the Object of the Relative Clause (resumptive pronoun), e.g.,

This is the man whom we met *him yesterday.

2. Subject Pronoun Retention (repetition of the subject pronoun in relative clauses), e.g.,

The girl who *she is beautiful came.

3. The Use of the Relative and Possessive Pronoun Instead of Whose, e.g.,

The man who *his blood was tested that.

4. Relative Pronoun Misselection (*which – who*)

This is the teacher *which* teaches us English.

5. Confusion of *who* and *whom*

The friend *whom* is clever failed the test.
6. Omission of the Relative Pronoun When It Describes an Indefinite Noun.

Ali is a man * doesn’t come late.

7. Omission of the Relative Pronoun

I want to speak about something * happened to me.

8. Omission of the Relative Antecedent, e.g.,

I don’t agree with * who says that the sun goes round the earth.

9-Wrong Number Concord (Agreement)in Relative clauses, e.g.,

The life of orphans who * hasn’t got enough love is a difficult one.

10-The Use of Coordination Instead of Subordination, e.g.,

She is an eccentric woman * and she always dresses as a bride.

11-Wrong Placemen of the Relative Clause, e.g.,

The boys were in the house * who were my friends.

7- Results and Discussion

The data for this study Taken from the modern play” Major Barbara” the well –known play writer Gorge Bernard Shaw in the table below, there is a presentation of the frequency,
categorization and percentage of relative clauses in Gorge Bernard Shaw's play “Major Barbara”.

Table 1

The Frequency, Categorization and Percentage of Occurrence of Each Type of Relative Clauses in G. B. Shaw's Play *Major Barbara*

<table>
<thead>
<tr>
<th>Percentage %</th>
<th>Total</th>
<th>Act III</th>
<th>Act II</th>
<th>Act I</th>
<th>Kind of RC and function</th>
</tr>
</thead>
<tbody>
<tr>
<td>15/118 = 12.7%</td>
<td>15</td>
<td>6</td>
<td>2</td>
<td>7</td>
<td>Restrictive RC Subject /Contact Form</td>
</tr>
<tr>
<td>57/118 = 48.3%</td>
<td>57</td>
<td>25</td>
<td>22</td>
<td>10</td>
<td>Restrictive RC Subject /Full form</td>
</tr>
<tr>
<td>26/118 = 22%</td>
<td>26</td>
<td>7</td>
<td>14</td>
<td>5</td>
<td>Non-Restrictive RC Subject /Contact Form</td>
</tr>
<tr>
<td>20/118 = 16.94%</td>
<td>20</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>Non-Restrictive RC Subject /Full form</td>
</tr>
<tr>
<td>118/168 = 70.238%</td>
<td>118</td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>12/35 = 3428%</td>
<td>12</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>Restrictive RC Direct Object /Contact Form</td>
</tr>
<tr>
<td>20/35 = 57.14%</td>
<td>20</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>Restrictive RC Direct Object /Full form</td>
</tr>
<tr>
<td>1/35 = 2.85%</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Non-Restrictive RC Direct Object /Contact Form</td>
</tr>
<tr>
<td>2/35 = 5.71%</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Non-Restrictive RC Direct Object /Full form</td>
</tr>
<tr>
<td>34/168 = 20.833%</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>0/4 = 0%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Restrictive RC Indirect Object /Contact Form</td>
</tr>
<tr>
<td>Restrictive RC</td>
<td>Non-Restrictive RC</td>
<td>Non-Restrictive RC</td>
<td>Total</td>
<td></td>
<td></td>
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<tr>
<td>Indirect Object /Full Form</td>
<td>Indirect Object /Contact Form</td>
<td>Indirect Object /Full Form</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>¾ = 75%</td>
<td>0/4 = 0%</td>
<td>¼ = 25%</td>
<td>4/168 = 2.380%</td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3/5 = 60%</td>
<td>2/5 = 40%</td>
<td>5/168 = 2.976%</td>
<td>5/168 = 2.976%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3/6 = 50%</td>
<td>3/6 = 50%</td>
<td>6/168 = 3.571%</td>
<td>6/168 = 3.571%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total**

<table>
<thead>
<tr>
<th>Restrictive RC</th>
<th>Non-Restrictive RC</th>
<th>Non-Restrictive RC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object of Preposition /Full Form</td>
<td>Object of Preposition /Contact Form</td>
<td>Object of Preposition /Full Form</td>
<td>Total</td>
</tr>
<tr>
<td>3/6 = 50%</td>
<td>3/6 = 50%</td>
<td>6/168 = 3.571%</td>
<td>6/168 = 3.571%</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

**Total**

<table>
<thead>
<tr>
<th>Possessive</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/6 = 50%</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>0</td>
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</tbody>
</table>

**Total**

<table>
<thead>
<tr>
<th>Object of Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/0%</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

**Total**
According to the table provided, the subject relative clause is the most frequent kind of relative clauses in George Bernard Shaw's Play Major Barbara. This kind has 118 occurrences which constitute 70.238%. It is divided into 4 subsections and they are exemplified from the three acts of the play as follows:

1. Restrictive RC Subject /Contact Form, e.g., I do beg you to let me alone for once, and tell me about this horrible business of my father wanting to set me aside for another son.

2. Restrictive RC Subject /Full Form. I am not one of those men who keep their morals and their business in watertight compartments. (MB. Act I).

3- Non-Restrictive RC Subject /Contact Form. Homer, speaking of Autolycus, uses the same phrase. (MB. Act I).

4. Non-Restrictive RC Subject /Full Form. Your Christianity, which enjoins you to resist not evil, and to turn the other cheek, would make me a bankrupt. (MB. Act I).

The category Restrictive Relative Clauses as Subject /Full Form, this category was found as the most frequent of all its kinds in the play under investigation (M.B). It counted 57 occurrences which constituted 48.3%. On other hand, the Non-Restrictive RC as Subject /Contact Form makes up to 26 occurrences which constitute 22%. The third category is Non-Restrictive RC Subject /Full Form. This category occurred 20 times which constituted 16.94%. The last category is Restrictive RC Subject /Contact Form.
This category was the least to occur in Bernard Shaw’s Play “Major Barbara”. It occurred only 15 times. This occurrence constitutes 12.7%. In fact, the previous discussion provides us with the view that the dominant type is Restrictive RC Subject /Full Form followed by Non-Restrictive RC Subject /Contact Form, then the Non-Restrictive RC Subject /Full Form, and finally is the Restrictive RC Subject /Contact Form. With regards to Direct Object which is considered the second major type of RCs, the following findings were detected:

The Direct Object occurrence was 35 times. This constitutes 20.833%, out of the occurrences of RCs in Bernard Shaw’s Play Major Barbara. The Direct Object is divided into 4 categories:

1. Restrictive RC Direct Object /Contact Form

Ever since they made her a major in the Salvation Army she has developed a propensity to have her own way. (MB. Act I).

2. Restrictive RC Direct Object /Full Form. I have a very strong suspicion that you went to the Salvation Army to worship Barbara and nothing else. (MB. Act I).

3. Non-Restrictive RC Direct Object /Contact Form. So the five thousand, I should think, is to save his soul. (MB. Act II).

4. Non-Restrictive RC Direct Object /Full Form
It is only in the middle classes, Stephen, that people get into a state of dumb helpless horror when they find that there are wicked people in the world. (MB. Act I).

First, restrictive RC direct object /full form occurred 20 times which constitute 57.14%. This type is considered the dominant one in Direct Object category. The second type is restrictive RC direct object /contact form which comes next in occurrence. It makes up 12 occurrences which constitute 34.28%. The non-restrictive RC direct object /contact form appeared only once in the play and makes up 2.85%. However, the non-restrictive RC direct object /full form occurred twice which constitute 5.71%. The third main type of RCs that is discussed in the study is the indirect object. It is divided into 4 subsections as follow:

1. Restrictive RC Indirect Object /Contact Form. The girl we gave the massage to is not here.

2. Restrictive RC Indirect Object /Full Form. Barbara was going to make the most brilliant career of all of you. And what does she do? Joins the Salvation Army; discharges her maid; lives on a pound a week; and walks in one evening with a professor of Greek whom she has picked up in the street. (MB. Act I).

3. Non-Restrictive RC Indirect Object /Contact Form. The student, Alice baked a cake for, is my roommate.

4. Non-Restrictive RC Indirect Object /Full Form. They stung into vivacity, to which their meal has just now given an almost jolly turn. (MB. Act II).
This type was rare and infrequently used in the play "Major Barbara" in occurrence. The total occurrence of it was only 4 times which constitute 2.380%. The restrictive RCs indirect object /full form occurred 3 times which constitute 75%, whereas non-restrictive indirect object /full form occurred only once in act II which constitutes 25%. On the other hand, the restrictive and non-restrictive RC indirect object /contact form didn’t appear in the play (MB) at all.

All in all, the occurrence of indirect object category is really rare as it appeared only 4 times throughout all the acts of the play (MB). This is a clear indicator that the indirect objet is not frequently used in the play which may be due to its difficulty or it is neglected (or avoided).

Oblique object is the fourth main type of relative clauses categories. The oblique is another infrequently used category. It is divided into 4 subsections:

1. Restrictive RC Object of Preposition /Contact Form. The mattress he slept on had several broken springs.

2. Restrictive RC Object of Preposition /Full Form. Ever since they made her a major in the Salvation Army she has developed a propensity to have her own way and order people about which quite cows me sometimes. (MB. Act I).
3. Non-Restrictive RC Object of Preposition /Contact Form. *I know the place, you spoke about.*

4. Non-Restrictive RC Object of Preposition /Full Form. *She sits down; and he goes to the armchair, into which he throws himself.* (MB. Act I).

The Oblique category occurred 5 times which constitute 2.976%. The restrictive RC object of preposition/full form occurred 3 times which constitute 60%. The nonrestrictive RC object of preposition/full form occurred twice. This occurrence constitutes 40%. The two categories restrictive and non-restrictive RCs as object of preposition/contact forms didn’t appear (occur) at all in all the acts of the play (MB).

The fifth type is the Possessive Relative Clause. This type is divided into two categories: Restrictive and Non-restrictive Possessive RCs. They appeared 6 times in the data taken from the table from the play, and constitute 3.571%. Each one of the restrictive and non-restrictive RCs of possessive appeared 3 times which constitute 50% for each. Here are examples from the play Major Barbara on both types:

1. Restrictive relative clause as possessive. *The oceans of blood, not one drop of which is shed in a really just cause!* (MB. Act II).
2. Non-restrictive relative clause as possessive. *There may have been some reason for it when the Undershafts could only marry women in their own class, whose sons were not fit to govern great estates. (MB. Act I).*

Concerning the object of comparison relative clauses, there was a complete absence in the data under investigation (didn't occur at all). *The only person that I was shorter than was Fritz.*

If we look at the aforementioned table, we found that there a high frequency of relative clauses as subordination device (168 times). The result also lend further support to that the relative clause on the upper level hierarchy are more frequently than the lower level. we found that the relative clauses as subject were more frequently used in the data occurred (118) time which constitute 70.238%. Then comes the direct object which constitutes 20.833%. of the total relative clauses. This proves that the subject and the direct object relative clauses are considered the upper level of hierarchy and are more frequently used than the other kinds of the relative clauses.

Besides, the result gives as confirmation that there is a lower frequency on the lower level of occurrence for relative clauses on the level of Keenan hierarchy. The results in the aforementioned table confirm the aims of the study that there is a lower frequency on the lower level of occurrence for relative clauses such as the indirect object, object of
preposition, possessive and object of comparison relative clauses. the indirect object occurred (4) times which constitutes 2.380%.

Object of preposition occurred (5) times which constitutes 2.976%. After that comes the possessive RCs occurred (6) times which constitute 3.571%. finally comes the object of comparison which didn’t appear at all (had no occurrence). these less frequently used types of relative clauses are less used even by nature speakers of English language especially object of comparison relative clauses which are rarely used or never occur in their natural speech one additional thing to be closely added I in this study is that the result didn’t agree with Keenan and Comries (1977) noun phrase Accessibility Hierarchy as the indirect object relative clause was not frequently used type, it occurred only time in the play which constitute of all relative clauses. So it can be classified as belonging to the lower level of noun phrase Accessibility Hierarchy.

8-Conclusion

All kinds of relative clauses categories according to Shaw’s Plays Major Barbara are divided into three categories in terms of frequency of occurrence: The first category is the most frequently used and the most accessible types of all relative clauses categories which include the subject relative clause (70.238%) and the direct object (20.833%).
The second category is the less frequently used or less accessible kind of relative clauses which include the possessive relative clause (3.571%). The object of preposition (2.976%). The third category is the object of comparison relative clause which is considered the least accessible type and is a very rarely used kind.

This type didn’t occur at all in the play. there is a high frequency of relative clauses as subordination devices. The results of the study are of a great importance that we know the most frequently used kinds of relative clauses that the native speakers of English use and the less frequent kinds which they use rarely and sometimes don’t use at all such as the object of comparison relative clause. So, we can concentrate on the most frequent types of relative clauses and teach them to our students. The teaching of grammar might be contextualized. The best way to contextualize grammar is to teach it through plays that suit the level of the students because plays contain dialogues that represent everyday language in real life situations.

Teachers give artificial examples to their students, instead there might be authentic material which are elicited from texts written by native speakers. There might be a concentration on the most frequent types of relative clauses in the teaching process such as subject, direct object and indirect object relative clauses.... etc we must use the most
frequent and most commonly used types of the relative clauses throughout the teaching process.

Reference


Hogbin, Elizabeth and Sony Jae Jung (2007) " *The Accessibility Hierarchy in"
Relativization: The Case of Eighteenth – and Twentieth – Century written English Narrative


Appendixes

Appendix A: "Major Barbara" 1. Subject Relative Clause

**Act I**

<table>
<thead>
<tr>
<th>Relative Clauses Sentences</th>
<th>No</th>
<th>Kind and function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>A person sitting on it [it is vacant at present] would have, on his right, Lady Britomart's writing table.</td>
<td>1</td>
<td>Restrictive RC Sub./Contact Form</td>
</tr>
<tr>
<td>Barbara was going to make the most brilliant career of all of you. And what does she do? Joins the Salvation Army; discharges her maid; lives on a</td>
<td>2</td>
<td>Restrictive RC Sub. /Full Form</td>
</tr>
</tbody>
</table>
pound a week; and walks in one evening with a professor of Greek whom she has picked up in the street, and who pretends to be a Salvationist.

I know your quiet, simple, refined, poetic people like Adolphus—quite content with the best of everything!

They cost more than your extravagant people, who are always as mean as they are second rate.

He can do nothing for us: he says, naturally enough, that it is absurd that he should be asked to provide for the children of a man who is rolling in money.

A little brute at King’s who was always trying to get up revivals, spoilt my Bible—your first birthday present to me—by writing under my name.

To do Andrew justice, that was not the sort of thing he did.

I do beg you to let me alone for once, and tell me about this horrible business of my father wanting to set me aside for another son.

Ever since that, the cannon business has always been left to an adopted foundling named Andrew Undershaft.

I will not have all the responsibility thrown on my shoulders.

Lomax, a young man about town, is like many

<table>
<thead>
<tr>
<th>Line</th>
<th>Restriction Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Restrictive RC Sub./Contact Form</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Non-Restrictive RC Sub./Full Form</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Restrictive RC Sub./Full Form</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Restrictive RC Sub./Full Form</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Non-Restrictive RC Sub./Full Form</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Restrictive RC Sub./Contact Form</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Restrictive RC Sub./Contact Form</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Restrictive RC Sub./Contact Form</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Non-Restrictive RC Sub./Contact</td>
<td></td>
</tr>
</tbody>
</table>
other young men about town.

He is affected with a frivolous sense of humor which plunges him at the most inopportune moments into paroxysms of imperfectly suppressed laughter.

The lifelong struggle of a benevolent temperament and a high conscience against impulses of inhuman ridicule and fierce impatience has set up a chronic strain which has visibly wrecked his constitution.

He is a most implacable, determined, tenacious, intolerant person who by mere force of character presents himself as--and indeed actually is--considerate, gentle, explanatory, even mild and apologetic, capable possibly of murder, but not of cruelty or coarseness.

By the operation of some instinct which is not merciful enough to blind him with the illusions of love, he is obstinately bent on marrying Barbara.

Homer, speaking of Autolycus, uses the same phrase.

Morrison, pale and dismayed, breaks into the room in unconcealed disorder.

His gentleness is partly that of a strong man who has learnt by experience that his natural grip hurts ordinary people.
| That is Charles Lomax, who is engaged to Sarah. | 22 | Non-Restrictive RC Sub. /Full Form |
| That is Sarah, your second daughter. | 23 | Non-Restrictive RC Sub./Contact Form |
| No: he says it's bad form to be a dissenter. | 24 | Restrictive RC Sub. /Contact Form |
| we blew twenty-seven dummy soldiers into fragments with a gun which formerly destroyed only thirteen. | 25 | Restrictive RC Sub. /Full Form |
| I am not one of those men who keep their morals and their business in watertight compartments. | 26 | Restrictive RC Sub. /Full Form |
| Your Christianity, which enjoins you to resist not evil, and to turn the other cheek, would make me a bankrupt. | 27 | Non-Restrictive RC Sub. /Full Form |
| Come, Dolly. Come, Cholly. [She goes out with Undershaft, who opens the door for her. Cusins rises]. | 28 | Non-Restrictive RC Sub. /Full Form |
| And then the father, who has nothing to do but pet them and spoil them, comes in when all her work is done and steals their affection from her. | 29 | 

**Act II**

| Relative Clauses Sentences | No | Kinds and functions of RC |
| Those who come from this central gable end into the yard have the gateway leading to the street on their left. | 1 | Restrictive RC Sub. /Full Form |
The man, a workman out of employment, is young, agile, a talker, a poser, sharp enough to be capable of anything in reason except honesty or altruistic considerations of any kind.

If they were rich people, gloved and muffed and well wrapped up in furs and overcoats, they would be numbed and miserable;

She used to beat me. No matter: you come and listen to the converted painter, and you'll hear how she was a pious woman that taught me prayers at er knee

Jenny Hill, a pale, overwrought, pretty Salvation lass of 18, comes in through the yard gate, leading Peter Shirley, a half hardened, half worn-out elderly man, weak with hunger

Holy God! I've worked ten to twelve hours a day since I was thirteen, and paid my way all through; and now am I to be thrown into the gutter and my job given to a young man that can do it no better than me because I've black hair that goes white at the first change?

You're only a jumped-up, jerked-off, orspittle-turned-out incurable of an ole workin man: who

2 Non-Restrictive RC Sub./Contact Form

3 Non-Restrictive RC Sub./Contact Form

4 Non-Restrictive RC Sub./Contact Form

5 Restrictive RC Sub./Full Form

6 Non-Restrictive RC Sub./Contact Form

7 Non-Restrictive RC Sub./Contact Form

8 Non-Restrictive RC Sub./Contact Form

9 Non-Restrictive RC Sub./Contact Form

10 Restrictive RC Sub./Full Form

11 Restrictive RC Sub./Full Form

12 Restrictive RC Sub./Full Form
<table>
<thead>
<tr>
<th>cares about you?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I know you. You’re the one that took away my girl.</td>
<td>13 Restrictive RC Sub. /Full Form</td>
</tr>
<tr>
<td>You’re the one that set eragen me.</td>
<td>14 Restrictive RC Sub. /Full Form</td>
</tr>
<tr>
<td>You Gawd forgive me again and I’ll Gawd forgive you one on the jaw that’ll stop you prayin for a week.</td>
<td>15 Restrictive RC Sub. /Full Form</td>
</tr>
<tr>
<td>Ain ’t you satisfied--young whelps like you--with takin the bread out o the mouths of your elders that have brought you up and slaved for you</td>
<td>16 Restrictive RC Sub. /Full Form</td>
</tr>
<tr>
<td>Barbara, brisk and businesslike, comes from the shelter with a note book, and addresses herself to Shirley. Bill, cowed, sits down in the corner on a form, and turns his back on them.</td>
<td>17 Non-Restrictive RC Sub. /Contact Form</td>
</tr>
<tr>
<td>Bill, cowed, sits down in the corner on a form, and turns his back on them.</td>
<td>18 Non-Restrictive RC Sub. /Contact Form</td>
</tr>
<tr>
<td>Perhaps it was you that cut her lip.</td>
<td>19 Restrictive RC Sub. /Full Form</td>
</tr>
<tr>
<td>I ’ll put you down as [writing] the man who--struck--poor little Jenny Hill--in the mouth.</td>
<td>20 Restrictive RC Sub. /Full Form</td>
</tr>
<tr>
<td>You see I was right about your trade. [Bill, on the point of retorting furiously, finds himself, to his great shame and terror, in danger of crying</td>
<td>21 Non- Restrictive RC Sub. /Contact Form</td>
</tr>
<tr>
<td>Number</td>
<td>Text</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>22</td>
<td>Somebody that doesn’t intend you to smash women’s faces, I suppose.</td>
</tr>
<tr>
<td>23</td>
<td>Somebody or something that wants to make a man of you.</td>
</tr>
<tr>
<td>24</td>
<td>A man with a heart wouldn’t have bashed poor little Jenny’s face, would he?</td>
</tr>
<tr>
<td>25</td>
<td>It’s your soul that’s hurting you, Bill, and not me.</td>
</tr>
<tr>
<td>26</td>
<td>Come. [A drum is heard in the shelter; and Bill, with agasp, escapes from the spell as Barbara turns quickly.</td>
</tr>
<tr>
<td>27</td>
<td>It picks the waster out of the public house and makes a man of him: it finds a worm wriggling in a back kitchen, and lo! a woman!</td>
</tr>
<tr>
<td>28</td>
<td>A s Barbara’s father, that is more your affair than mine. I can feed her by teaching Greek: that is about all.</td>
</tr>
<tr>
<td>29</td>
<td>The power Barbara wields here—the power that wields Barbara herself—is not Calvinism, not Presbyterianism, not Methodism—</td>
</tr>
<tr>
<td>30</td>
<td>Indifferent to their own interests, which suits me exactly.</td>
</tr>
<tr>
<td>31</td>
<td>[ indicating Peter Shirley, who has just came from the shelter and strolled dejectedly down the yard between them] And this is an honest man!</td>
</tr>
</tbody>
</table>
Snobby Price, beaming sanctimoniously, and Jenny Hill, with a tambourine full of coppers, come from the shelter and go to the drum, on which Jenny begins to count the money.

Barbara: [who has dried her eyes and regained her composure]

The man that hit me. Oh, I hope he's coming back to join us.

Bill Walker, with frost on his jacket, comes through the gate, his hands deep in his pockets and his chin sunk between his shoulders, like a cleaned-out gambler.

this bloominforgivin an noggin an jawrin that makes a man that sore that izlawf's a burdn to im.

The coin fascinates Snobby Price, who takes an early opportunity of dropping his cap on it].

It makes life bearable to millions of people who could not endure their existence if they were quite sober.

It makes life bearable to millions of people who could not endure their existence if they were quite sober.

the bad blood of the fierce little cowards at home who egg on others to fight for the gratification of their national vanity!

| 32 | Non-Restrictive RC Sub. /Contact Form |
| 33 | Non-Restrictive RC Sub. /Contact Form |
| 34 | Restrictive RC Sub. /Full Form |
| 35 | Restrictive RC Sub. /Full Form |
| 36 | Non-Restrictive RC Sub. /Contact Form |
| 37 | Restrictive RC Sub. /Full Form |
| 38 | Restrictive RC Sub. /Full Form |
| 39 | Non-Restrictive RC Sub. /Full Form |
| 40 | Restrictive RC Sub. /Full Form |
| 41 | Restrictive RC Sub. /Full Form |
The longer I live the more proof I see that there is an Infinite Goodness that turns everything to the work of salvation sooner or later.

He gives the time with his drum; and the band strikes up the march, which rapidly becomes more distant as the procession moves briskly away.

### Act III

<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No</th>
<th>Kinds and Function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think it was Dionysos who made me drunk.</td>
<td>1</td>
<td>Restrictive RC Sub. /Full Form</td>
</tr>
<tr>
<td>In good society in England, Charles, men drivel at all ages by repeating silly formulas with an air of wisdom.</td>
<td>2</td>
<td>Restrictive RC Sub. /Contact Form</td>
</tr>
<tr>
<td>I want a man with no relations and no schooling: that is, a man who would be out of the running altogether if he were not a strong man.</td>
<td>3</td>
<td>Restrictive RC Sub. /Full Form</td>
</tr>
<tr>
<td>You don't say so! What! no capacity for business, no knowledge of law, no sympathy with art, no pretension to philosophy; only a simp[pl]knowledge of the secret that has puzzled all the philosophers, You can't tell me the bursting strain of a ten-</td>
<td>4</td>
<td>Restrictive RC Sub. /Contact Form</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Restrictive RC Sub. /Full Form</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Non- Restrictive RC Sub. /Full Form</td>
</tr>
</tbody>
</table>
inch gun, which is a very simple matter; but you all think you can tell me the bursting strain of a man under temptation

That points clearly to a political career. Get him a private secretaryship to someone who can get him an Under Secretaryship; and then leave him alone.

I don't. They do. You see, the one thing Jones won't stand is any rebellion from the man under him, or any assertion of social equality between the wife of the man with 4 shillings a week less than himself and Mrs Jones!

The result is a colossal profit, which comes to me.

Do you think I can be happy in this vulgar silly dress? I! who have worn the uniform.

Lady Britomart, dressed for out-of-doors, opens it before he reaches it

Across the crest runs a platform of concrete, with a parapet which suggests a fortification, because there is a huge cannon of the
obsolete Woolwich Infant pattern peering across it at the town.

The parapet has a high step inside which serves as a seat.

Barbara is leaning over the parapet, looking towards the town. On her right is the cannon; on her left the end of a shed raised on piles, with a ladder of three or four steps up to the door, which opens outwards and has a little wooden landing at the threshold, with a fire bucket in the corner of the landing.

The parapet stops short of the shed, leaving a gap which is the beginning of the path down the hill through the foundry to the town.

Behind the cannon is a trolley carrying a huge conical bombshell, with a red band painted on.
Further from the parapet, on the same side, is a deck chair, near the door of an office, which, like the sheds, is of the lightest possible construction.

Everything perfect, wonderful, real. It only needs a cathedral to be a heavenly city instead of a hellish one.

Stephen, who is quite close to it, looks at it rather scaredly, and moves away quickly to the cannon.

Lomax, who appears in the doorway.

New blood that is wanted in English business.

A bounce that expresses her downright

How you can succeed in business when you are willing to pay all that money to a University don who is obviously not worth a junior clerk’s wage!

Lazarus is gentle romantic Jew who care for nothing but string quarters and stall at
Fashionable theatres.

To give arms to all men who offer an honest price for them, without respect of persons or principles.

What do we do here when we spend years of work and thought and thousands of pounds of solid cash on a new gun or an aerial battleship that turns out just a hairsbreadth wrong after all?

Well; de we do here when we spend years of work at loss that bring it nearer bankruptcy every year?

It is cheap work converting starving men with a Bible in one hand and a slice of bread in the other.

Your pious mob fills up ballot papers and imagines it is governing its masters; but the ballot paper that really governs is the paper that has a bullet wrapped up in it.

The history of the world is the history of those who had courage enough to embrace this truth.

You lust for personal righteousness, for self-approval, for what you call a good conscience, for what Barbara calls salvation, for what I call patronizing people who are not so lucky as yourself.

My bravest enemy. That is the man who keeps me up to the mark.
He turns to Lady Britomart, who rises

It is not the sale of my soul that troubles me

Now the power that is made here can be wielded by all men

This power which only tears men's bodies to pieces has never been so horribly abused as the intellectual power, the imaginative power, the poetic, religious power that can enslave men's souls

I want to arm them against the lawyer, the doctor, the priest, the literary man, the professor, the artist, and the politician, who, once in authority, are the most dangerous, disastrous,

but the moment our money ran short, it all came back to Bodger: it was he who saved our people

I should have given you up and married the man who accepted it

Oh, did you think my courage would never come back? did you believe that I was a deserter? that I, who have stood in the streets, and taken my people to my heart

coming from the shed and stopping on the steps, obstructing Sarah, who follows with Lomax
<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No</th>
<th>Kind and Function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>I want a <strong>house in the village</strong> to live in with Dolly</td>
<td>48</td>
<td>Restrictive RC Sub./ Contact Form</td>
</tr>
<tr>
<td><strong>2. Direct object Relative Clause, Act I</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Relative Clauses Sentence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To do Andrew justice, that was not the sort of thing he did.</td>
<td>1</td>
<td>Restrictive RC D. Object. /Contact Form</td>
</tr>
<tr>
<td>I t is only in the middle classes, Stephen, that people get into a state of dumb helpless horror when they find that there are wicked people in the world.</td>
<td>2</td>
<td>Non=Restrictive RC D. Object/Full Form</td>
</tr>
<tr>
<td>I t is not only the cannons, but the war loans that Lazarus arranges under cover of giving credit for the cannons</td>
<td>3</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>When my father remonstrated, Andrew actually told him to his face that history tells us of only two successful institutions:</td>
<td>4</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>I do not find it an unpleasant subject, my dear. It is the only one that capable people really care for</td>
<td>5</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>I have a very strong suspicion that you went to the Salvation Army to worship Barbara and nothing else</td>
<td>6</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>Ever since they made her a major in the Salvation</td>
<td>7</td>
<td>Restrictive RC D. Object. /Contact Form</td>
</tr>
</tbody>
</table>
Army she has developed a propensity to have her own way

2. Direct object Relative Clause, Act II

<table>
<thead>
<tr>
<th>Relative clauses sentence</th>
<th>No</th>
<th>Kind of function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>You lie! you have the bread and treacle in you that you come here to beg</td>
<td>1</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>O h, I know: you’re the man that Jenny Hill was praying for inside just now</td>
<td>2</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>I t combs our air and makes us good little blokes to be robbed and put upon</td>
<td>3</td>
<td>Restrictive RC D. Object. /Contact Form</td>
</tr>
<tr>
<td>Don’t you be afeerd. You ain’t such prime company that you need expect to be sought after</td>
<td>4</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>Ah! it’s a pity you never was trained to use your reason, miss</td>
<td>5</td>
<td>Restrictive RC D. Object. /Contact Form</td>
</tr>
<tr>
<td>Holy God! I’ve worked ten to twelve hours a day since I was thirteen, and paid my way all through; and now am I to be thrown into the gutter and my job given to a young man</td>
<td>6</td>
<td>Restrictive RC D. Object. /Contact Form</td>
</tr>
<tr>
<td>Relation is our business at present, because it is through relation alone that we can win Barbara</td>
<td>7</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>Sentence</td>
<td>Number</td>
<td>Type</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>--------</td>
<td>--------------------</td>
</tr>
<tr>
<td>It 's this Christian game o yours that I won't av played agen me:</td>
<td>8</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>So the five thousand, I should think, is to save his soul.</td>
<td>9</td>
<td>Non- Restrictive RC D. Object. /Contact Form</td>
</tr>
<tr>
<td>I t enables Parliament to do things at eleven at night that no sane person would do at eleven in the morning</td>
<td>10</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>Is it Bodger's fault that this inestimable gift is deplorably abused by less than one per cent of the poor?</td>
<td>11</td>
<td>Restrictive RC D. Object. /Contact Form</td>
</tr>
<tr>
<td>Now Rummy, bustle. Take in those mugs and plates to be washed; and throw the crumbs about for the birds.</td>
<td>12</td>
<td>Restrictive RC D. Object. /Contact Form</td>
</tr>
<tr>
<td>Barbara: will there be less drinking or more if all those poor souls we are saving come to-morrow and find the doors of our shelters shut in their faces?</td>
<td>13</td>
<td>Restrictive RC D. Object. /Contact Form</td>
</tr>
<tr>
<td>[ with a reasonableness which Cusins alone perceives to be ironical] My dear Barbara: alcohol is a very necessary article</td>
<td>14</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>Think of my business! think of the widows and orphans! the men and lads torn to pieces with shrapnel and poisoned with lyddite</td>
<td>15</td>
<td>Restrictive RC D. Object. /Contact Form</td>
</tr>
<tr>
<td>Cusins rushes to the drum, which he takes up and</td>
<td>16</td>
<td>Non-Restrictive RC D. Object. /Full Form</td>
</tr>
</tbody>
</table>
puts on.

### 2. Direct object Relative Clause, Act III

<table>
<thead>
<tr>
<th>Relative clauses sentence</th>
<th>No</th>
<th>Kind of function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is nothing that any Italian or German could do that Stephen could not do.</td>
<td>1</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>That's just it: all the foundling I can find are exactly like Stephen</td>
<td>2</td>
<td>Restrictive RC D. Object. /Contact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Form</td>
</tr>
<tr>
<td>But I find now that you left me in the dark as to matters which you should have explained to me years ago.</td>
<td>3</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>And in return you shall have the support and applause of my newspapers, and the delight of imagining that you are a great statesman</td>
<td>4</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>You are very properly proud of having been industrious enough to make money; and it is greatly to your credit that you have made so much of it.</td>
<td>5</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>But when we took your money he turned back to drunkenness and derision</td>
<td>6</td>
<td>Restrictive RC D. Object. /Contact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Form</td>
</tr>
<tr>
<td>I stood on the rock I thought eternal</td>
<td>7</td>
<td>Restrictive RC D. Object. /Contact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Form</td>
</tr>
<tr>
<td>Well, you have made for yourself something that you call a morality or a religion or what</td>
<td>8</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
</tbody>
</table>
In your Salvation shelter I saw poverty, misery, cold and hunger

And you, Adolphus, ought to know better than to go about saying that wrong things are true.

I do not: all the poet in me recoils from being a good man. But there are things in me that I must reckon with: pity--

I have sold it to escape being imprisoned for refusing to pay taxes for hangmen’s ropes and unjust wars and things that I abhor.

3-indirect object relative clauses Act I

<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No</th>
<th>Kind and Function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbara was going to make the most brilliant career of all of you. And what does she do?</td>
<td>1</td>
<td>Restrictive RC D. Object. /Full Form</td>
</tr>
<tr>
<td>Joins the Salvation Armey; discharges her maid; lives on a pound a week; and walk in one evening with a professor of Greek whom she has picked up in the street.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3-indirect object relative clauses Act II

<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No</th>
<th>Kind and Function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>They stung into vivacity, to which their meal has just now given an almost jolly turn.</td>
<td>1</td>
<td>Non- Restrictive RC D. Object. /Full Form</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No.</th>
<th>Kind and Function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-indirect object relative clauses Act III</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I shall sell cannons to whom I please and refuse them to whom I please.</td>
<td>1</td>
<td>Restrictive RC In. Object. /Full Form</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Restrictive RC In. Object. /Full Form</td>
</tr>
<tr>
<td><strong>4. Object of Preposition Relative Clause. Act I</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>She sits down; and he goes to the armchair, into which he throws himself].</td>
<td>1</td>
<td>Non-Restrictive RC Object of Prep. /Full Form</td>
</tr>
<tr>
<td>Ever since they made her a major in the Salvation Army she has developed a propensity</td>
<td>2</td>
<td>Restrictive RC Object of Prep. /Full Form</td>
</tr>
<tr>
<td>to have her own way and order people about which quite cows me sometimes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>And I quite appreciate the very clever way in which you systematically humbug me. I have</td>
<td>3</td>
<td>Restrictive RC Object of Prep. /Full Form</td>
</tr>
<tr>
<td>found you out. Take care Barbara doesn't. That's all</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4. Object of Preposition Relative Clause. Act II</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I’m intelligent--fffff! it’s rotten cold here [he dances a step or two]--yes: intelligent</td>
<td>1</td>
<td>Restrictive RC Object of Prep. /Full Form</td>
</tr>
</tbody>
</table>
the station o life into which it has pleased the
capitalists to call me

<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No</th>
<th>Kind and Function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snobby Price, beaming sanctimoniously, and Jenny Hill, with a tambourine full of coppers, come from the shelter and go to the drum, on which Jenny begins to count the money</td>
<td>2</td>
<td>Non-Restrictive RC Object of Prep. /Full Form</td>
</tr>
</tbody>
</table>

4. Object of Preposition Relative Clause. Act III

<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No</th>
<th>Kind and Function of RC</th>
</tr>
</thead>
</table>

5. Possessive Relative Clause. Act I

<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No</th>
<th>Kind and Function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>There may have been some reason for it when the Undershafs could only marry women in their own class, whose sons were not fit to govern great estates.</td>
<td>1</td>
<td>Non-Restrictive RC Possessive</td>
</tr>
</tbody>
</table>

5. Possessive Relative Clause. Act II

<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No</th>
<th>Kind and Function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>[looking at Bill, whose attitude has never changed, and whose expression of brooding wrath has deepened] Oh, we shall cure him in no time. Just watch.</td>
<td>1 2</td>
<td>Non-Restrictive RC Possessive</td>
</tr>
</tbody>
</table>
the oceans of blood, not one drop of which is shed in a really just cause!

5. Possessive Relative Clause. Act III

<table>
<thead>
<tr>
<th>Relative Clauses Sentence</th>
<th>No</th>
<th>Kind and Function of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>You must simply sell cannons and weapons to people whose cause is right and just, and refuse them to foreigners and criminals.</td>
<td>1</td>
<td>Restrictive RC Possessive</td>
</tr>
<tr>
<td>A will of which I am a part.</td>
<td>2</td>
<td>Restrictive RC Possessive</td>
</tr>
</tbody>
</table>

6. Object of Comparison Relative Clause. Act I

<table>
<thead>
<tr>
<th>Relative Clauses Sentences</th>
<th>No</th>
<th>Kinds and functions of RC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td></td>
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</tbody>
</table>

6. Object of Comparison Relative Clause. Act I

<table>
<thead>
<tr>
<th>Relative Clauses Sentences</th>
<th>No</th>
<th>Kinds and functions of RC</th>
</tr>
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<tbody>
<tr>
<td></td>
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</tbody>
</table>

6. Object of Comparison Relative Clause. Act I

<table>
<thead>
<tr>
<th>Relative Clauses Sentences</th>
<th>No</th>
<th>Kinds and functions of RC</th>
</tr>
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<tr>
<td></td>
<td>0</td>
<td></td>
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</tbody>
</table>
Appendix: Suggested Plan on How to Use Literature to Teach Grammar in the Classroom

The researcher suggests a plan on how to use literature to teach grammatical structures and practice them with communicative activities in a real context in the EFL classroom as follows:

1. The teacher displays a picture from the play if any. Otherwise, he can choose a picture and ask the students to describe it. Teacher writes the sentences the students say about the relative clauses on the board and comments briefly on them to make the students form an idea on how to form relative clauses.

2. The teacher can choose extracts or an extract, a scene or part of a scene from a play that suits the level of students and contains relative clause structures.

3. The teacher gives the students an idea about the selected piece of writing or text.

4. The teacher divides the students into group and asks them to read the chosen text silently and underline the relative clauses and write them in their notebooks.

5. The teacher asks the student in groups to divide the relative clauses in the text into their types, subject, object, possessive.... etc.

6. The teacher can use the relative clauses that the students underline in the text and make many exercises on the relative clauses. For example, let’s make some exercises from the play Major Barbara by George Bernard Shaw.

A. Fill in the spaces with the right relative pronouns: who, which, whose and whom.

1. I am not one of those men .......... keep their morals and their business in watertight compartments.

2. Cusins rushes to the drum, .......... he takes up and puts on.
3. I shall sell cannons to ........ I please and refuse them to whom I please.

4. looking at Bill, whose attitude has never changed, and ........... expression of brooding wrath has deepened] Oh, we shall cure him in no time. Just watch.

B. Choose the correct answers a, b, or c

1. Stephen, ..........is quite close to it, looks at it rather scaredly, and moves away quickly to the cannon. a. whose. b. who c. which

2. Cusins rushes to the drum, ........ he takes up and puts on.

a. who b. whose c. which

C. Combine the following pairs of sentences with the right relative pronouns who, which, whose and whom so as to make one sentence.

1. The coin fascinates Snobby Price. He takes an early opportunity of dropping his cap on it.

...........................................................................................................................................................................

2. Stephen looks at it rather sacredly, and moves away quickly to the cannon. He is quite close to it.

...........................................................................................................................................................................

3. There may have been some reason for it when the Undershafts could only marry women in their own class. Their sons were not fit to govern great estates.

...........................................................................................................................................................................

D. Correct the relative pronouns in the following sentences.

1. There is nothing whom any Italian or German could do that Stephen could not do.

2. I shall sell cannons to who I please and refuse them to whom I please.

3. She sits down; and he goes to the armchair, into whose he throws himself].

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4. A will of who I am a part.

E. Decide whether the following sentences are restrictive or non-restrictive relative clauses:

1. You must simply sell cannons and weapons to people whose cause is right and just  
……………………

2. Your Christianity, which enjoins you to resist not evil, and to turn the other cheek, would  
make me a bankrupt.  

3. I have a very strong suspicion that you went to the Salvation Army to worship  
Barbara and nothing else.  

7. Then, the teacher asks the students to act out the chosen extracts from the play in  
grupos (as role playing) according to the number of the actors in the chosen text.  

So, teaching English grammar (structures) through literature such as plays will  
be of great benefit for Arab EFL learners because plays capture the learners’ attention and  
motivate them throughout reading the text. Another example, plays provide the grammatical  
items with rich context which can empower the students and give them the opportunity to use  
these items such as the relative clauses in a real context that made them more memorable  
and easy to understand.
Critical Factors Influencing the Implementation of Public Infrastructure Projects in Kenya: A case of Thika Sub-County, Kiambu County Kenya

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** Professor of Entrepreneurship & Technology Innovation, Jomo Kenyatta University of Agriculture and Technology, Kenya
*** Dean School of Mathematics, Jomo Kenyatta University of Agriculture and Technology, Kenya

Abstract- Infrastructure projects play a big role in societies in terms of meeting the development needs of the economy and more so in transforming the quality of life of citizens. The government is the single largest implementer of public infrastructure projects thus there is need to ensure that these projects are fully implemented and the factors that have the greatest influence identified to ensure their influence is taken into consideration during the project life cycle. It was therefore the purpose of this study to investigate the critical factors influencing the implementation of public infrastructure projects in Kenya, a case of thika-sub county in Kiambu Kenya. The objectives of the study were to assess whether government policies, funding process, and participatory planning process have an influence on the implementation of public infrastructure projects in Kenya, a case of thika-sub county in Kiambu, Kenya. Based on the theories from critical factors influencing public infrastructure implementation, the study developed a conceptual framework. Targeting a population of 650 project consultants and the project direct beneficiaries a sample of size of 242 was drawn using the Krejcie and Morgan table (1970). The study used descriptive survey research design to obtain the data and both qualitative and quantitative research approaches. Data was collected using self-administered questionnaire and analysed using the descriptive and inferential statistics and the results presented using tables. The findings of the study revealed that there is a significant statistical relationship between the critical factors: government policies, funding process and participatory planning process; and the implementation of public infrastructure projects. The study has also provided the conclusions based on the findings and recommendations on the implementation of public infrastructure projects.

Index Terms- Project Management, infrastructural projects, public infrastructure projects, projects implementation.

I. INTRODUCTION

In order to release economic prosperity and well-being in a developing country like Kenya, it is paramount that the focus should be on infrastructure projects. In less developed countries therefore, public infrastructure development projects have the potentiality to facilitate sustainable development through the application of modern management methods and techniques as a result of ease of interaction with various experts in different fields. This pivotal role played by public infrastructure projects in sustainable development is recognized in chapter 27 of Agenda 21 of UN (UN charter 1945). Dailami and Klein (1997) while working on a policy paper on government support to private infrastructure projects in emerging markets notes that the role played by public infrastructure projects which includes fighting poverty, opening markets and disposing illiteracy in equal measure cannot be ignored. They further assert that efforts should be put to ensure that every public infrastructure project initiated is fully implemented. Perrot and Chatelus (2000) notes that in financing of major infrastructure and public service projects the government is usually the biggest sponsor. Most public infrastructure in Kenya therefore according to Kenya public infrastructure report of 2015, are funded by the government whilst minority are funded by non-government entities such as the industrialized countries including USA, Canada, and Sweden through their development funding agencies which are United States Agency for International Development (USAID), Canadian International Development Agency (CIDA), and Sweden International Development Agency (SIDA) respectively. Many scholars (Sappington &Stiglitz, 1987; Perrot &Chatelus, 2000; Dailami & Klein, 1997; Reeves, 2004) are of the opinion that public infrastructure projects in emerging economies like Kenya in most common cases are not fully implemented as per their original proposals and targets.

1.1 Statement of the Problem

Njoki (2013) while studying construction projects in Kenya notes that public infrastructure projects have taken a slow pace since independence. The records from the Kenya government 2014 on vision 2030 towards a globally competitive and prosperous Kenya (GOK, 2007) indicates that slow pace in implementation of public infrastructure projects has led to poor road networks; under standardized public amenities which includes schools, hospitals and clinics; non connectivity of the national grid line to industrial potential areas; poor mitigation measures in agricultural areas which is the food basket of the country; and poor mechanization of the once competitive industries that are going under. Waiganjo, Mukulu and Kahiri (2012) observed that the Kenyan government in recent years introduced crucial projects geared towards public infrastructure development through the constituency development fund (CDF), the KaziKwaVijana (KKV) initiative, and the national youth service development programme (NYSDP). Even though these
initiatives bore fruits in some quarters, it is the view of Waiganjo, Mukulu and Kahiri that the implementations of these projects were not fully achieved.

Lango (2015) while studying the critical success factors of fire safety projects in Kimbdu county notes that Thika sub-county which is in Kimbu had one of the lowest implementation rating on public infrastructure development projects. A report by the county assembly notes that infrastructural development projects like roads within the jurisdiction of the county government takes as long as twice the amount of time it ought to take to completion (Lango, 2015; Njoki, 2013).

County governments play an important role in free service delivery offered through public infrastructure development and their full implementation is a catalyst for economic growth. This study therefore was undertaken to fulfill the knowledge gap on comprehending the bigger picture in implementation of public infrastructure projects by looking at the critical factors of consideration. This study therefore was to verify why factors applied in public infrastructure projects does not lead to its full implementation and in essence investigate the critical factors influencing implementation of public infrastructure projects in thika sub-county in Kimbu, Kenya.

1.2 General Objective
To investigate the critical factors influencing the implementation of public infrastructure projects in Thika Sub-County, Kimbdu Kenya.

1.3 Specific Objectives
1. To determine the influence of government policies on implementation of public infrastructure projects in Thika Sub-County, Kimbdu Kenya.
2. To determine the influence of funding process on implementation of public infrastructure projects in Thika Sub-County, Kimbdu Kenya.
3. To determine the influence of participatory planning process on implementation of public infrastructure projects in Thika Sub-County, Kimbdu Kenya.

1.4 Hypotheses
The research sought to ascertain the validity or otherwise of the following hypotheses:

\( H_{01} \): Government policies do not influence implementation of public infrastructure projects in Thika Sub-County, Kimbu Kenya.

\( H_{02} \): Funding process do not influence implementation of public infrastructure projects in Thika Sub-County, Kimbu Kenya.

\( H_{03} \): Participatory planning processes do not influence implementation of public infrastructure projects in Thika Sub-County, Kimbu Kenya.

1.5 Justifications
This research has documented the critical factors influencing the implementation of infrastructure projects in Thika Sub-county, Kimbdu Kenya which in essence could be made available to the county governments in Kenya as a basis for establishing a strong background in ensuring that the infrastructure projects are implemented fully. The study further provides a structured approach to public infrastructure projects implementation by providing the critical factors to focus on and eliminating the adhoc, haphazard, and obsolete adhoc focus on methods rather than coherent and actionable plans.

1.6 Scope
The study was restricted to Thika Sub-county in Kimbu county Kenya. This study was conducted at the Thika Sub-county because the researcher had easy access to data collection and on-site analysis and the fact that Thika sub-county has been part of selected areas that have implemented major government public infrastructure projects in all sectors of its economy.

1.7 Limitations
The researcher noted that public infrastructure projects are multi-sectorial and multi-disciplinary in nature and involves different county departments including roads and transport; health; sports and culture; labour and social welfare; tourism and recreation; and finance. Therefore the greatest limitation to this study was the cross sectional majority of data to be investigated. To avoid this however, the researcher made sure that the data collected focused on the critical factors influencing public infrastructure projects implementations.

II. LITERATURE REVIEW
This section reviews the literature relevant to the study objective areas and presents a conceptual framework for which the study is based.

2.1 Government Policies
The growing focus on governments to implement public infrastructure projects as a major platform to gain public trust and support has increased policy interests in the same area. Kerr and Newell (2001) while looking at projects dealing with policy induced technology adoption, notes that government departments and projects implementing agencies depend on these policies to ensure that public infrastructure project meets certain pre-conditions and post-conditions. While the policies do not make it mandatory for the project initiators to incorporate the project recipients, Kerr and Newell argues that the policies should cut across the project’s sectorial engagement in order to meet the pre-and-post- requirements. Governments develop policies that are geared towards mass implementation of large infrastructure projects with the main aim of pursuing social goals and to correct society failures and promote economic efficiency (Kaiser & Ahlemann, 2010). Further in implementation of projects, policies are developed to achieve the goals of redistribution of resources from one group of people to another group to achieve same level development. This according to Kaiser and Ahlemann (2010) should be done at minimum cost. Otieno et al (2010) opined that an ideal policy on project implementation should focus on the project’s effectiveness, where the projects implementation prospects should meet the institutional, regulatory and socio-economic goals of the recipients in a manner that is appropriate to the proponents of the project. Furthermore a good policy should advocate for effectiveness which entails the project to be as cost effective as possible, fair dealing, where the stakeholders

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should be treated equally without discrimination or prejudice including protection of confidentialities of the project where necessary (Otierno et al., 2010). Njoki (2013) asserts that policies should aid project implementation by upholding the integrity of the project to ensure informed decision making which requires public infrastructure projects to base their implementation on accurate information and ensure basic requirements are met. World Bank (2002) on the other hand requires transparency to enhance public infrastructure projects openness and clarity. The main objectives of government policies therefore is to link public infrastructure projects planning, budgeting, and achieving financial requirements during the implementation process.Macharia and Ngugi (2014) while studying the determinants of successful completion of power projects in Kenya power and lighting company notes that government policies on mega projects plays a greater role as it influences the size, structure, conduct and performance of the government entity during implementation process.

2.2 Funding Process

Njoki (2013) notes that the funding and funding process is vital in the implementation of the public infrastructure projects in Kenya and a process that is clearly not outlined within the structure of the funding agency may well interfere with the implementation of projects that are scheduled to be executed. Macharia and Ngugi (2014) also asserts that the funding process in any public infrastructure project is usually hampered by the contractors who do not have adequate funds for the project. This, according to Macharia and Ngugi, is the major hindrance to a structured detailed process in funding of public infrastructure projects. The major funding process according to Otiendo et al. (2010) encompasses the funding for the construction materials, labourers, salaries and remuneration, and equipment to be used during the work processes. Otiendo et al. therefore contends that key in public infrastructure project is its funding processes and without which can lead to the project facing financial difficulties. This is also supported by Kaiser and Ahlemann (2010) who argue that without a clear funding process in any public infrastructure implementation may lead to the project contractor applying poor materials and also leads to inefficient communication, unreliable suppliers, and late project deliveries. Wanjiku (2012) while studying the factors influencing performance of contractors of government funded building projects notes that the implementation of public infrastructure projects is heavily influenced by funding process and if not structured systematically then this leads to financial issues, poor human resources, wrong designation of site characteristics and poor design qualities.

Public infrastructure project funding, according to Esty and Christoy (2002), is one where the funds must include its reliance on the project’s ability to cover costs related to its interest and debt repayment, the risk sharing principles, the non or limited recourse financing, off-balance sheet financing, and the involvement of various forms of other sources of capital during the implementation process. This fact is supported further by Daube, Vollrath and Alfen (2008) in their comparision study of project financing and the forfeiting model as financing forms for Public-Private-Partnership (PPP) projects in German where they opined that the key ingredient that ensure a project’s implementation is the assets, contracts, and cash flows obtained from the funding entities to sustain the project to completion. Further, they note that any project funding structure should ascertain that there will be adaptability to the various needs of the public infrastructure project demands during the implementation process. From the authors and others including Hainz and Kleimeier (2006), project funding in public infrastructure projects plays an important role in the implementation process.

2.3 Participative Planning Process

Reeves (2004) defines participative planning process in public infrastructure projects as all the activities by which members of the public including citizens, users and consumers contribute to shaping the decisions taken by public organizations. Further the purpose and methods of fostering the participative process must be in scale or spectrum with the level of consultations at one end and more deliberative techniques on another end. This according to Reeves is to ensure that participative planning process promotes deliberate public infrastructure projects but necessarily a prescription on the method to use. Njoki (2013) notes that participative planning process occurs in infrastructure projects at the government level and the local county governments where the projects are implemented.Njoki further notes that these participatory activities should be mapped to eliminate the bureaucratic participative processes that are traditional including written consultations to include more modern approach that includes the focus groups and opinion polls.Dailami and Klein (1997) opined that the public appetite for participation and involvement in public infrastructure projects is mixed although there is not much literature on the involvement of the public on participatory planning processes during public infrastructure projects. The demand for participation, according to Dailami and Klein, depends on several factors which includes: whether the project is national or county government originated; what the law prescribes as enough public participation; and whether proof of public participation will eventually make much difference. Perrot and Chatelus (2000) believe that the reforms of public structures and governing systems is the key to public infrastructure projects development implementation however there is still a debate amongst the stakeholders’ of how vast the participatory public processes in public infrastructure projects should be attained in policy making and the major role of the elected representatives. Sappington and Stiglitz (1987) on the hand argue that the major enablers of public participations includes capacity and resources of the projects, the social capital and the attitudes of political players in the project area of implementation, and the managerial and civil society leaders engaged in the project processes. It however believed that the level of participation in a public infrastructure project relies so heavily on those on power and the process is never considered so important (Dailami and Klein, 1997).

2.4 Theoretical Review

The theoretical framework considered various theories for this particular study which are discussed below.

2.4.1 Institutional Theory
Zucker (1987) view institutional theory as one providing a rich but complex view of an organization and observed that in most cases these organizations are influenced by normative pressures either arising internally or externally such as the state policies or policies from the county and sub-county governments. Further these policies which are essentially pressures, lead a county government to be guided by legitimated elements which may include standard operating procedures, procurement rules, disposal and compensation procedures and state requirements which may often have an effect on directing attention away from public projects implementations. Macharia and Ngugi (2014) however note that the institutional theory is inherently difficult to explicate as it taps public projects taken-for-granted assumptions at the core of the social harbour. The main aim of this study therefore is to make the institutional theory more accessible and understood in terms of government policies, Robey and Holmstrom (2001) while studying transforming municipal governance in global context taking a case study of the dialectics of social change, notes that institutional theory tenders to focus on the more resilient aspects of social structure and considers processes by which structures, schemas, rules, norms, and routines become more established as the authoritative guidelines for public infrastructure implementation.

2.4.2 Systems Theory

System theory tends to explain why many public infrastructure projects tend to fail and according to Bertalanffy (1972) the failure is mostly attributed to the various processes in place that the system must adhere to in order to be completed. One of these processes includes the funding process of the project and Bertalanffy hypothesizes that everything is part of a larger independent movement and most importantly centered on clarifying the whole of the project, its parts, and the relations between them. Public infrastructure project at the sub-county government incorporates many funding agencies which take into consideration the local, county, national, public, private and non-profit units within the project’s implementation area of jurisdiction. Bertalanffy suggests that the systems theory acknowledges that successfully implemented projects requires a streamlined funding process, outlines the stages of funding and states while describing the project activities for implementation to be funded. The funding system therefore should be one that is open for project variances during the implementation process either in the upward or downward during the project period (Otieno et al., 2010). Further the interactions between the various funding agencies of the project affect the implementation of project. Nudurupati, Garengo and Tuner (2007) while studying the dynamics of performance measurement and organizational culture while applying systems theory found out that it is the best model in studying the critical factors influencing public infrastructure implementations due to its specialization in organization systems, the availability of researched material data, its uses on measurements of psychometric in nature and the fact that it is the dominant model for investigating service delivery in the public arena.

2.4.3 Participatory Development Theory

Chambers (1997) opined that participatory development theory seeks to ensure the inclusion of local beneficiaries of a public infrastructure project into the activities of the project implementations. Further that the project’s participatory planning must take into consideration the local population which in this case the sub-county residents to the enable the public infrastructure development implementation success. Mohan (2008) on the other hand observes that participatory development theory promotes the improvement of efficiency and effectiveness of formal public infrastructure development programmes and the external and the local actors of the project must be involved. This theory according to Chambers (1997) therefore devices a means of planning in development at the sub-county level which must involve the local sub-county communities and uses various planning tools which includes the Participatory Rural Appraisal (PRA) as one of the formal planning tools. Chambers add that by planning for projects and especially in devolved systems of governance causes a shift in power relations by valorizing voices that usually go unheard by political development groups as it seeks to include the illiterate, poor, marginalized people and all groups to represent own lives and livelihoods affected by the projects. Participatory Development theory therefore, according to Mohan (2008) increases the sub-county population, who are also the local recipients of the projects, ability to be self-determining in the implementation of the public infrastructure projects.

2.5 Conceptual Framework

![Conceptual Model on Critical Factors Influence on Implementation of Public Infrastructure Project](image)

The conceptual framework, adapted from Macharia and Ngugi (2014), illustrates the influence of the critical factors which includes government policies, funding process and participatory planning process on the implementation of public infrastructure projects.
2.6 Summary and Research Gaps

Wanjiku (2012) notes that in 2003 the Government of Kenya initiated a change implementation process aimed at reforming the public sector that specifically focused on the use of public resources and the implementation of public infrastructure development projects. This process according to Wanjiku gave birth to oversight institutions such as the Anti-Corruption authority, the financial management departments, the public procurement and oversight authority among other that were charged with the responsibilities of ensuring that public infrastructure projects are implemented as per the required standards. In particular, Othieno et al. (2010) opined that the public procurement oversight authority ensured that the procurement process of public infrastructure projects were transparent, with accountability and reduced wastage of public resources. However Lango (2015) while quoting an independent procurement review by the Government of Kenya (GoK) and the European Union (EU) noted that there were still weak oversight institutions, lack of transparency in projects acquisitions, poor linkages between procurements and expenditures, delays and inefficiencies and poor records management of public infrastructure projects. Macharia and Ngugi (2014) indicate that one of the major challenges in public infrastructure implementation is the corruption levels being experienced in different levels of governments. Macharia and Ngugi indicates that in 2004 Kenya was selected to receive the Threshold Programme (TP) by the Millenium Challenge Corporation (MCC) but noted that Kenya failed four of the six MCC indicators including the control of corruption that hampers the implementation of public infrastructure projects. Wanjiku (2012) notes that Kenya has continued to fail in its infrastructure projects implementation and to improve indicates that a focus must be on the critical factors that influence the implementation process.

As noted by various authors (Wanjiku, 2012; Macharia and Ngugi, 2014; Lango, 2015; Njoki, 2013) urban areas in Kenya including thika sub-county in Kiambu are growing rapidly as rural dwellers migrate in search of opportunities presented by the heavy infrastructure development in these towns. The devolved government and the central government are having difficulties in responding to the infrastructural needs of these urban areas with the recent development policies giving local politicians with no prior background in development the financial and decision-making power to plan and implement major public infrastructural development projects (Lango, 2015). This in essence according to Wanjiku (2012) the politicians and their proxies inflate the project funding costs and further in collusion with the contractors use shoddy materials and inefficient project materials during implementation resulting to low-quality completed public infrastructures. Njoki (2013) while studying construction projects in Nairobi Kenya opined that construction infrastructure projects fail due to poor considerations on the project costs, its documentation and the stakeholders involved. The study however did not focus on other infrastructure development projects and the factors of considerations only looked at the project in its entity without considering the external contributing factors that includes government policies, project funding, and participatory procedures. Other studies also follow a similar script albeit with a different logical conclusion and it is therefore the objective of this study to assess the influence of critical factors on the implementation of public infrastructure projects.

III. METHODOLOGY

3.1 Research Design

The research employed a descriptive survey research design to obtain data that helped to determine the critical factors influencing public infrastructure projects implementation and specifically to determine the characteristics of a large group. According to Creswell (2005) this design involves collecting original data in form of questionnaire for describe a population which was too large to observe directly. The research used quantitative approach because the research collected information from a large population of public infrastructure project consultants and consulting beneficiaries in order to answer the research questions.

3.2 Target Population

Creswell (2005) describes the target population as all the members of a real or hypothetical set of people, objects or events to which a researcher intends to generalize their results of the study. The study target 650 projects consultants and project direct beneficiaries within thika sub-county. Table 3.1 summarizes the target population:

Table 3.1: Target Population

<table>
<thead>
<tr>
<th>Category</th>
<th>Target Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Consultants</td>
<td>150</td>
<td>23.1</td>
</tr>
<tr>
<td>Project Direct Beneficiaries</td>
<td>500</td>
<td>76.9</td>
</tr>
<tr>
<td>Total</td>
<td>650</td>
<td>100.00</td>
</tr>
</tbody>
</table>

3.3 Sample size and Sampling Procedure

Krejcie and Morgan Table (1970) was used to determine the sample sizes as it uses a formula which has been proven over time. Based on the target population the sample size was 242 with 52 and 245 for project consultants and project direct beneficiaries respectively. Table 3.2 below gives a summary of the sample size.

Table 3.2: Sample Size

<table>
<thead>
<tr>
<th>Category</th>
<th>Target Population</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Consultants</td>
<td>150</td>
<td>56</td>
</tr>
<tr>
<td>Project Direct Beneficiaries</td>
<td>500</td>
<td>186</td>
</tr>
<tr>
<td>Total</td>
<td>650</td>
<td>242</td>
</tr>
</tbody>
</table>

3.4 Research Instruments

Data was collected using two instruments which were the Project Consultants Questionnaire (PCQ) and the Project Direct Beneficiaries Interview Schedule (PDBIS). While the PCQ was a structured questionnaire the PDBIS was an interview schedule designed to guide in the interviewing of the public infrastructure projects direct beneficiaries and especially in the vicinity of the project undertaken.

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3.5 Piloting
The research instruments were piloted with one infrastructure project and its direct beneficiaries in Ruiru-sub County within Kiambu County which experienced the same conditions but were not involved in the study. The reliability of the PCQ was checked and that of the PDBIS. This pilot study also offered an opportunity for the researcher to familiarize with the data collection process.

3.5 Reliability and Validity
Creswell (2005) describes validity of research as the degree to which evidence supports any inferences a researcher makes based on the research data collected using a specific instrument. In order to ascertain validity of the instruments expert opinion was sought from the college of human resource and management and the department of statistics of Jomo Kenyatta University of Agriculture and Technology (JKUAT).

Reliability according to Mugenda and Mungenda (2003) is the measure of a research instrument to yield consistent results after repeated trials. A test-retest method was used to assess the reliability of the data. The PCQ and the PDBIS was administered twice and the second administering was done after a one week lapse of time to check whether it gave the same results. In order to determine the extent the questionnaires were able to obtain a consistent result each time it was administered, a correlation coefficient was computed. A reliability coefficient of at least 0.7 was accepted as recommended by Creswell (2005).

3.7 Data Collection Procedures
The PCQ and PDBIS were left with the project consultants and project direct beneficiaries respectively for response and were later collected after one week. In case of questionnaire which the respondent could not be traced at the time of the audit, a new questionnaire was given and a date set for collection that did not exceed three days later. A selection of the project consultants and the beneficiaries were interviewed to ascertain issues and clarification of data obtained. This was thematic on government policies, funding process, participatory planning and their influence on public infrastructure projects implementation.

3.8 Data Analysis Techniques
The questionnaires from the various respondents were screened, cleaned, coded and entered in an SPSS Version 21.0 computer software for analysis and this was then edited for completeness and consistency with the variables of analysis. The collected quantitative data was analyzed using descriptive statistics which included the frequency distributions tables, mean and percentages.

3.8.1 Empirical Model
The research was guided by a linear regression model that relates to factors influencing public infrastructure projects implementation. The model was then indicated as:

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \]

Where:
Y - is public infrastructure projects implementation
X_1 - is Government Policies
X_2 - is Funding Process
X_3 - is Participatory Planning Process

3.8.2 Test of Significance
The research used inferential statistics to test the significance of the overall model at 95% level of significance and the coefficient of correlation (r) used to determine the magnitude of the relationship between the dependent and independent variables. Coefficient of determination (r^2) will also be used to show the percentage for which each independent variable and all independent variables combined will be explaining the change in the dependent variables.

IV. DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.0 Introduction
This chapter presents the data analysis, presentation and interpretation of the findings on the critical factors influencing the public infrastructure implementation. The collected data was collated and descriptive table reports generated.

4.1 Questionnaire Return Rate
The researcher administered 242 questionnaires and collected 228 which constituted 94.2% response rate for the data collection. The table 4.1 below shows the various response distributions for the project consultants and project direct beneficiaries.

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Consultant</td>
<td>55</td>
<td>22.7</td>
</tr>
<tr>
<td>Project Direct Beneficiaries</td>
<td>173</td>
<td>71.5</td>
</tr>
<tr>
<td>Total</td>
<td>228</td>
<td>94.2</td>
</tr>
</tbody>
</table>

The 94.2% was rated by the researcher as a high response from a simple random sample of 242 and according to the American Association for Public Opinion Research (AAPOR, 2008) is generally accepted as opposed to a low response rate from the same sample.

4.2 Characteristics of the Respondents
The research also looked at the common characteristics of the respondents and specifically presents the analysis and findings on the respondents gender, age, highest academic level, and marital status.

4.2.1 Gender
The study also made an analysis of the respondents’ gender and table 4.2 outlines the gender of the respondents.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>147</td>
<td>64.5</td>
</tr>
<tr>
<td>Female</td>
<td>81</td>
<td>35.5</td>
</tr>
<tr>
<td>Total</td>
<td>228</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 4.2 shows that the male respondents were the majority at 64.5% while female minority at 35.5%. This result clearly shows that the male are favored in the society and more so in public infrastructure implementation.

### 4.2.2 Age

Table 4.3 shows the respondents age distribution as the various categories of selection.

**Table 4.3: Respondent Age Distribution**

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 - 25</td>
<td>47</td>
<td>20.6</td>
</tr>
<tr>
<td>26 – 35</td>
<td>58</td>
<td>25.5</td>
</tr>
<tr>
<td>36 – 45</td>
<td>104</td>
<td>45.6</td>
</tr>
<tr>
<td>56 and Above</td>
<td>19</td>
<td>8.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>228</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

From table 4.3 it was evident that majority of those involved in public infrastructure project either as consultants or as direct beneficiaries or both were between the ages of 36 – 45 representing 45.6% while those not actively involved either directly or indirectly were those between the ages of 56% and above representing 8.3%. This is probably because most of the public infrastructure projects require intensive activities and the age group falling between 36 – 45 are in their prime age and more active. The lower youth cadres falling between the age brackets of 18 – 25 were only 47 representing 20.6% while middle youth bracket between 26 – 35 responded at 58 representing 25.5%.

### 4.2.3 Highest Academic Level

Table 4.4 describes the highest academic levels of the respondents and includes both the project consultants and the direct beneficiaries.

**Table 4.4: Respondents Academic Levels**

<table>
<thead>
<tr>
<th>Highest Academic Level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>23</td>
<td>10.1</td>
</tr>
<tr>
<td>Certificate</td>
<td>45</td>
<td>19.7</td>
</tr>
<tr>
<td>Diploma</td>
<td>57</td>
<td>25.0</td>
</tr>
<tr>
<td>Degree</td>
<td>88</td>
<td>38.6</td>
</tr>
<tr>
<td>Post-Graduate</td>
<td>15</td>
<td>6.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>228</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

From the data distribution in table 4.4 it was evident that the respondents had at least basic education with those with only basic education which encompasses primary and secondary level qualification being 23 representing 10.1%. Majority at 88 (38.6%) of the respondents had a degree level qualification showing the competitiveness of the public infrastructure projects skills level entry while the minority at 15 (6.6%) were those with post graduate level qualification. Those with certificate and diploma level qualification were 45 (19.7%) and 57 (25.0%) respectively.

### 4.2.4 Marital Status

The study also sought to find out the marital status of the respondents to ascertain the level of dependency of those involved in the study. Table 4.5 outlines the marital status of the respondents.

**Table 4.5: Respondents Marital Status**

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>76</td>
<td>33.3</td>
</tr>
<tr>
<td>Single</td>
<td>141</td>
<td>61.9</td>
</tr>
<tr>
<td>Divorced</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Widowed</td>
<td>11</td>
<td>4.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>228</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Majority of the respondents at 141 (61.9%) indicated that they were single perhaps reflective of the low number of child births in Kiambu County (Macharia&Ngugi, 2014) while minority at 11 (4.8%) indicated they were widowed. Those who were married were at 76 representing 33.3% while none indicated they were divorced.

### 4.3 Verification of Hypotheses

This section analyses and verifies the three hypotheses from the respondents’ data and also documents observations made during the study.

#### 4.3.1 Hypothesis One (H₀₁): Government policies do not influence implementation of public infrastructure projects in Thika Sub-County, Kiambu Kenya

One of the major reasons advanced by various quotas implementing public infrastructure projects is the government adherence to policies and procedures in the process. It is on this precepie that the researchers sort to find out the influence of government policies on the implementation of public infrastructure projects in Thika sub-county government. Table 4.6 presents the findings on the government policy factors influencing implementation of the public infrastructure projects.

**Table 4.6: Government Policy Factors**

<table>
<thead>
<tr>
<th>Government Policy Factors</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies set up to allow public participation in projects</td>
<td>4.600</td>
<td>.75592</td>
</tr>
<tr>
<td>Policy interest on projects support infrastructure investment and incentives</td>
<td>4.236</td>
<td>.75095</td>
</tr>
<tr>
<td>Public policies change with technological inventions influencing infrastructure projects directly and indirectly</td>
<td>4.486</td>
<td>.92722</td>
</tr>
<tr>
<td>Interest groups advocate for public policies that serve the desire of their members for particular infrastructure projects</td>
<td>4.860</td>
<td>.57393</td>
</tr>
<tr>
<td>Business groupings promote government policies for infrastructure projects in the best interest of the grouping</td>
<td>4.923</td>
<td>.63732</td>
</tr>
</tbody>
</table>

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impact in public infrastructural spending for benefit of the beneficiaries

Government policies regulate the use of public infrastructure implementation and usage upon completion

The county has developed constituent policies to deal with public infrastructure fiscal policy in some circumstances

The data for the analysis was collected using a 1 to 5 point likert scale with 1=Very Low, 2=Low, 3= Moderate, 4= High and 5= Very High. The respondents were asked to indicate their levels of agreement with the government policy factors influence on public infrastructure project implementation. The scale was designed to allow the respondents express their level of agreement or disagreement with a particular statement as listed. Each of the responses were then coded into numerical value used to measure their perceptive value under investigation. The score low and very low were combined into one to represent a variable having a mean score of 0 to 2.5 on the continuous likert scale. The scores of ‘moderate’ have been taken to represent a variable with a mean score of 2.5 to 3.4 on the continuous likert scale and the score of ‘high’ and ‘very high’ were combined to represent a variable with a mean score of 3.5 to 5.0 on the same scale. A standard deviation of greater than 1.0 implied a significant difference on the impact of the variables among the respondents of the study.

From the study findings it is evident that majority of the respondents were of the opinion that government policies focusing on the impact in public infrastructural spending for benefit of the beneficiaries will have the greatest impact scoring a mean of 4.9232. A further majority were also of the opinion that the county develops constituent policies to deal with public infrastructure fiscal policy in some circumstances; and that interest groups advocate for public policies that serve the desire of their members for particular infrastructure projects, with mean scores of 4.8296 and 4.8600 respectively. The other factors of considerations in government policies influence in public infrastructure projects gave varied mean scores as follows: Government policies regulate the use of public infrastructure implementation and usage upon completion scoring mean of 4.6223; Policies set up to allow public participation in projects scoring 4.6000; Public policies change with technological inventions influencing infrastructure projects directly and indirectly scoring 4.4860; Business groupings promote government policies for infrastructure projects in the best interest of the grouping scoring 4.4360; and Policy interest on projects support infrastructure investment and incentives scoring 4.2360. The overall positive influence of the government policies on public infrastructure implementation was found to have resulted to a positive debate on infrastructure development and implementation. The responses indicate that the government policies have an influence on the implementation process of public infrastructure projects.

4.3.2 Hypothesis Two (H₂): Funding process does not influence implementation of public infrastructure projects in Thika Sub-County, Kiambu Kenya.

The data for the analysis was collected using a 1 to 5 point likert scale with 1=Very Low, 2=Low, 3= Moderate, 4= High and 5= Very High. The respondents were asked to indicate their levels of agreement with the funding process factors influence on public infrastructure project implementation. The scale was designed to allow the respondents express their level of agreement or disagreement with a particular statement as listed. Each of the responses were then coded into numerical value used to measure their perceptive value under investigation. The score low and very low were combined into one to represent a variable having a mean score of 0 to 2.5 on the continuous likert scale. The scores of ‘moderate’ have been taken to represent a variable with a mean score of 2.5 to 3.4 on the continuous likert scale and the score of ‘high’ and ‘very high’ were combined to represent a variable with a mean score of 3.5 to 5.0 on the same scale. A standard deviation of greater than 1.0 implied a significant difference on the impact of the variables among the respondents of the study.

Table 4.7: Funding Process Factors

<table>
<thead>
<tr>
<th>Funding Process Factors</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commitment and continuity of lead financier of a project determines its implementation speed and quality</td>
<td>4.6000</td>
<td>.86956</td>
</tr>
<tr>
<td>Ability of project consultants and beneficiaries to negotiate and maintain a core set of relationship in project implementation influences funding process</td>
<td>4.9365</td>
<td>.46356</td>
</tr>
<tr>
<td>Clear description, testing and external validation of public infrastructure funds determines its potential</td>
<td>3.9751</td>
<td>1.45251</td>
</tr>
<tr>
<td>Skills to be acquired during the public infrastructure implementation determines the funding process</td>
<td>4.9002</td>
<td>.77524</td>
</tr>
<tr>
<td>Aligning project funding process to economic and environmental benefits enables smooth implementation</td>
<td>3.8245</td>
<td>1.7521</td>
</tr>
<tr>
<td>Funding process that considers stakeholders in the short-term and long-term leads to effective implementation</td>
<td>4.7854</td>
<td>.42055</td>
</tr>
<tr>
<td>Long-term success and sustainability of the project funding lies with the engagement of project consultants and the direct beneficiaries</td>
<td>4.8578</td>
<td>.78545</td>
</tr>
<tr>
<td>Funding process must take into consideration a budgeting plan for mitigation of risks and externalities</td>
<td>4.9921</td>
<td>.78542</td>
</tr>
</tbody>
</table>

From the study findings it was evident that majority of the respondents were of the opinion that funding process must take into consideration a budgeting plan for mitigation of risks and externalities scoring 4.9921; ability of project consultants and beneficiaries to negotiate and maintain a core set of relationship in project implementation influences funding process scoring mean of 4.9365; and skills to be acquired during the public infrastructure implementation determines the funding process.
scoring 4.9002. The other factors of funding process had varied scores as follows: Long-term success and sustainability of the project funding lies with the engagement of project consultants and the direct beneficiaries scoring 4.8578; Funding process that considers stakeholders in the short-term and long-term leads to effective implementation scoring 4.7854; Commitment and continuity of lead financier of a project determines its implementation speed and quality scoring 4.6000; Clear description, testing and external validation of public infrastructure funds determines its potential scoring 3.9751; and finally aligning project funding process to economic and environmental benefits enables smooth implementation scoring 3.8245.

4.3.3 Hypothesis Three (H3): Participatory planning processes do not influence implementation of public infrastructure projects in Thika Sub-County, Kiambu Kenya.

The data for the analysis was collected using a 1 to 5 point likert scale with 1=Very Low, 2=Low, 3= Moderate, 4= High and 5= Very High. The respondents were asked to indicate their levels of agreement with the participatory planning process factors influence on public infrastructure project implementation. The scale was designed to allow the respondents express their level of agreement or disagreement with a particular statement as listed. Each of the responses were then coded into numerical value used to measure their perceptive value under investigation. The score low and very low were combined into one to represent a variable having a mean score of 0 to 2.5 on the continuous likert scale. The scores of ‘moderate’ have been taken to represent a variable with a mean score of 2.5 to 3.4 on the continuous likert scale and the score of ‘high’ and ‘very high’ were combined to represent a variable with a mean score of 3.5 to 5.0 on the same scale. A standard deviation of greater than 1.0 implied a significant difference on the impact of the variables among the respondents of the study.

<table>
<thead>
<tr>
<th>Participatory Planning Process Factors</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaders initiating public infrastructure projects are visible active and support the county during implementation process</td>
<td>4.7000</td>
<td>.46287</td>
</tr>
<tr>
<td>The culture within the county encourages innovation and change in public infrastructure developments</td>
<td>4.6521</td>
<td>.45950</td>
</tr>
<tr>
<td>Communication during public infrastructure project is two-way i.e. from and to project management and the beneficiaries</td>
<td>4.1270</td>
<td>.96425</td>
</tr>
<tr>
<td>There is formal planning and strategic change implementation process that targets the public infrastructure projects implemented and their beneficiaries</td>
<td>4.7568</td>
<td>.65821</td>
</tr>
<tr>
<td>There is a formal and personal development for the staff consulting for a particular project and direct uptake of skills from project beneficiaries</td>
<td>4.9245</td>
<td>.58752</td>
</tr>
</tbody>
</table>

There is formal data gathering and analysis process for monitoring change by the project consultants to the project direct beneficiaries scoring 4.7215 and, of There is formal planning and strategic change implementation process that targets the public infrastructure projects implemented and their beneficiaries scoring a mean of 4.7568. However most of the respondents were of the opinion that Communication during the public infrastructure project is not two-way i.e. from and to project management and the beneficiaries as it scored 4.1270. The other factors scored as follows: Leaders initiating public infrastructure projects are visible active and support the county during implementation process with a mean of 4.7000; there is formal data gathering and analysis process for monitoring change by the project consultants to the project direct beneficiaries having a mean score of 4.7215; and finally the culture within the county encourages innovation and change in public infrastructure developments scoring a mean of 4.6521.

4.4 Regression Analysis

In order to determine the critical factors influencing public infrastructure projects implementation at the thika-sub county, the study conducted a regression analysis. The three variables of critical factors considered were government policies, funding process and participatory process to implementation of public infrastructure projects in thika sub-county.

\[ Y = \beta_0 + \beta_1 \text{Government Policies} + \beta_2 \text{Funding Process} + \beta_3 \text{Participatory Planning} + \epsilon \]

Where:

- \( \beta_0 \) is the regression constant, \( \beta_1 - \beta_3 \) are regression coefficients and \( \epsilon \) is the model error term which indicates its significance. Table 4.9 therefore gives the model of goodness fit.

<table>
<thead>
<tr>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of Estimate</th>
<th>Durbin – Watson</th>
</tr>
</thead>
<tbody>
<tr>
<td>.761a</td>
<td>.678</td>
<td>.646</td>
<td>.22452</td>
<td>2.149</td>
</tr>
</tbody>
</table>

a. Predictors: (constants), Government Policies, Funding Process, Participatory Planning Process
b. Dependent Variable: Public Infrastructure Projects Implementation.

From the table of model of goodness fit generated above the study established the linear dependence of the critical factors influencing the public infrastructure projects in thika sub-county. The study established a correlation coefficient of 0.761 which is a strong positive correlation depicting a near perfect linear dependence between the dependent and independent variables.
An R-square of 0.678 was established and adjusted to 0.646 with the coefficient of determination depicting that government policies, funding process and participatory planning process brings about 67.8% variation in public infrastructure projects implementation at the Thika-sub county while 32.2% of the variations are brought about by factors not captured by the objectives of this particular study. The Durbin Watson value of 2.149 illustrated that there is lack of autocorrelation in the model residuals.

The study further established the regression coefficients of the various variables and presented in table 4.10 below.

<table>
<thead>
<tr>
<th></th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>1.348</td>
<td>.563</td>
<td>2.845</td>
<td>.514</td>
</tr>
<tr>
<td>Government Policies</td>
<td>.192</td>
<td>.048</td>
<td>2.562</td>
<td>.002</td>
</tr>
<tr>
<td>Funding Process</td>
<td>.642</td>
<td>.132</td>
<td>3.821</td>
<td>.026</td>
</tr>
<tr>
<td>Participatory Planning Process</td>
<td>.245</td>
<td>.124</td>
<td>3.635</td>
<td>.005</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Public Infrastructure Project Implementation
The regression equation becomes:
\[ Y = 0.192X1 + 0.642X2 + 0.245X3 \]

From the findings it is evident that the regression model depicts that when government policies, funding process and participatory planning process have a null value, the public infrastructure implementation would be 1.348. This therefore means that when all other factors are constant, a unit increase in the perceptive value of government policies would yield a 0.192 decrease in the public infrastructure project implementation while a unit increase in perceptive value of funding process and participatory planning process would yield 0.642 and 0.245 respectively.

4.5 Discussion of Findings
The findings of this study have reinforced the current reality at the county governments and by extension the sub-county governments that public infrastructure projects implementation is influenced by certain factors in its environment and that this is characterized by turbulence that is consistent.

4.5.1 Comparison to Theories
The study constructed three objectives which were to determine the influence of: government policies; funding process; and participatory planning process on the implementation of public infrastructure projects. From the findings it is evident that government policies, funding process, and participatory planning process have an influence on public infrastructure implementation. These findings are confirmed by Robey and Holmstrom (2001) who while studying transformation of municipal governance in a global context contends that infrastructure development projects implementations are dynamic, evolving and change in response to environmental changes which might include government policies and procedures, the sources of finance and the participation of the locals in its initial plans. Further they asserts that an environment that is non-specific to conditional changes and experiences various turbulences leads to the project implementers identifying the most gratifying critical factors of considerations. These factors Mohan (2008) confirms must relate to government procedures, rules and regulations and also include the source of finance for the project and the participation of the local populace into the activities of the project from its inception to completion. Further findings are confirmed by the system theorists like Bertalanffy (1972) who asserts that public infrastructure projects implementation success depends majorly on the various planning processes that includes the funding process and participatory process of the stakeholders involved.

4.5.2 Comparison to other Studies
The findings of other study also warns that for the public infrastructure implementation to succeed the actors and the various stakeholders must be cognizant of the various critical factors to take into consideration with a view to ensuring a complete success. The study found that the integral critical factor in public infrastructure must include the compliance to government policies which directly and indirectly to the projects. These findings are also confirmed by Njoki (2013) while studying construction projects in Nairobi, Kenya, and Ker and Newell (2001) who studied projects with policy induced technology adoption and noted that government projects and more so public infrastructural development projects mostly depend on policies to ensure that they meet certain pre and post conditions geared towards their success in implementation. This is further confirmed by Otieno et al. (2010) who also noted that government policies plays a vital role in the implementation of projects and the policies should be geared towards mass implementation of public infrastructure projects.

Infrastructure funding process as per the study findings also contributes immensely to the outcome and quality of any given infrastructure projects. The study also assurps that funding process within a structured project implementation leads to systematic review of the stages of the projects that are geared towards achieving the implementation target. These findings are in concurrent with Kaiser and Ahlemann (2010) who opined that funding process in any project must be clearly articulated in order for the contractors of the project to apply quality materials and Wanjiku (2012) on her study of factors influencing performance of contractors of government funded building projects further notes that if the funding is not structured it can...
lead to poor human resource and low quality implemented projects.

The study also found out that participative planning process is vital in the lifeline of a project and especially in the implementation process to ensure coherence and sequence of understanding in the procedures, policies, process, regulations and laws as it applies to the project until it is fully implemented. Reeves (2004) confirms these findings it definition of participative planning process as one that encompasses the whole project actors and their sequence of activities that leads to fully implemented project. Njoki (2013) further notes that participative planning process must be embraced at the national and county government levels to ensure that initiated projects are fully implemented and the players involved are aware of their roles at the various stages of the project until full implementation is achieved. The demand for participation therefore must be based on several factors as identified by the study and concurred by Dailami and Klein (1997).

V. CONCLUSIONS AND RECOMMENDATIONS

Based on the responses from the respondents this research came up with findings and were used to make conclusions and give recommendations. Based on the findings of and discussions above, the study makes the following conclusions and recommendations:

Conclusions

From the findings the following issues were observed from the as directly emanating from data analyzed:

- There is a strong gender disparity at the public infrastructure projects being implemented as there are more men than women. This is largely because construction profession which is the larger implemented projects is still considerably viewed as a Man’s job in Kenya and the larger African communities.
- Majority of those working at public projects being implemented are graduates with those with no qualifications at all missing at some sites. This is an indicator that the population has an influx of graduates as most of the project activities undertaken did not require specialized training or qualification.
- Most of the project managers do not have a pre-requisite qualification on project management apart from the specialized qualification which is only related to a project cycle stage. In most instances therefore, the project engineers were bestowed with the responsibility of doubling up as the project managers.

According the above discussions and summary thereafter, the following conclusions can be drawn from the study:

With regards to government policies and public infrastructure implementation, there was a statistically significant relationship between the two variables. Government policies influences public infrastructure implementation and a project supported by most policies is likely to be implemented to completion than one that is not.

On the other hand funding process and public infrastructure projects implementation also had a statistically significant relationship. Funding process influencing the projects implementation progress and its eventual completion and further determines in advance the sources of finance for the project outlining the various levels of finance and the specific activities it will be funding.

In regards to participatory planning process and public infrastructure projects implementations, there was a statistically significant relationship between the two variables. Perceived participatory planning process has a direct and indirect influence on the public infrastructure implementation. Perceived participatory planning process in terms of stakeholders participation on the project increases the likelihood of the project success and with low perception of success, there is a likelihood of project implementation failure.

Recommendations

Based on the findings of the study and the conclusions made above, this study recommends the following on critical factors influencing public infrastructure implementation:

(i) Public infrastructure project implementers must take into considerations all the government policies in place and comply with all policies to ensure that the project is sealed from the direct or indirect influence of these policies. Of particular interest should be the mandatory policies that every project must comply with before its implementation. Government policies that are relevant to the project should serve as the key implementation criteria for the project.

(ii) To ensure that public infrastructure projects are geared towards full implementation, the funding process should be taken into consideration with specific outlines on the main funding source, the minor and the emergency funds for the project. The usage of these funds should be well outlined in the funding process to gag on misuse and under or over spending by overzealous project management implementers.

(iii) To overcome the risk associated with non-involvement of stakeholders during the implementation process, the public infrastructure project should have a mechanism in place that ensures that a participatory planning process is in place and involves all those that the project affects directly and indirectly. Perceived non-involvement of stakeholders creates anxiety among the stakeholders and especially those directly affected by the project and may lead to total rejection of the project. It will be of high importance to involve the stakeholders early in the project stages to ensure that they own and defend the project.

REFERENCES


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THE AVAILABILITY OF CEMENT TOWARDS INFRASTRUCTURAL DEVELOPMENT IN BANTEN: A DYNAMIC SYSTEM MODEL ANALYSIS

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Abstract - Infrastructures are no doubt important to speed economic development in the province of Banten. Due to this reason the government of Banten gives a serious concern toward infrastructural development in this province. However, studies estimating the availability of cement to support the infrastructural development in Banten have been limited. This study, by using a dynamic system simulations, aims at estimating the availability of cement for the infrastructural construction in the future. The data were collected from the official statistics and other secondary sources. The study found that the demand for cements will exceed the supply of cement between the period 2018 and 2025. This study suggests the following actions that need to be given serious attention by the provincial government of Banten. First, there is a need to increase the number of cement industries in the province of Banten. Second, the provincial government should introduce conducive policies to attract investors to invest in cement industries to support the sustainability of cement production. Third, the development of cement industries should be environmentally friendly. Fourth, there is a need to develop a large capacity of cement production. Finally, the government needs to monitor the availability of cements to mitigate the gap between the supply and demand of cements in this region.

Index terms - the supply and demand of cements, Dynamic Systems model, infrastructural development, conducive policies.

1. INTRODUCTION

Infrastructure can simply be defined as the physical systems that provide transportation, water, buildings, and other public facilities required to meet human basic needs both economically and socially. In the province of Banten, like in many other provinces in Indonesia, the development of infrastructure is no doubt important as the engine of economic growth. This is because the availability of infrastructures is able to increase productivity, cost efficiency and attracting investments (Szirmai, 2010). For this reason, the development of infrastructure is a must for any regions to have rapid economic growth.

In the province of Banten, however, the availability of infrastructure was limited. The provincial government of Banten consequently since 2010 established regional plan to speed the development of infrastructures. This provincial development plan has attracted the growing of construction companies. Between the period 2013 and 2014, the number of construction companies increased from 2,413 units to 2,440 units with the construction value reached 11.8 trillion rupiah. The number of the construction companies was reported increasing since these periods. Judging from the type of work, nearly 60 percent of the construction value was for civil buildings such as roads and bridges. The rest is just only buildings (17.9 %) and other special construction (19.3 %) respectively (Banten Provincial Statistics, 2015).

Apart from the above building types, the development of housing and the like are also rapid in this province. This is not surprising as the population of this province grow quiet rapidly. The rapid development of infrastructures certainly have a linear positive relationship with the need of cement supply as one of the important building materials. However, as there have been limited studies in estimating the supply of cement to support the infrastructural development in this province, this study is considered important to be undertaken.

Method to estimate the supply of cement is by using a dynamic system simulation model. This simulation model will be done by using computer statistical program of SPSS version 20, Power Sim studio for Windows 2005 and Pro model 7.5. Using this simulation model, it is expected that the availability of cement that needs to be supplied in the future by the construction industries in the province can be estimated. This estimation hopefully can be used for the provincial government of Banten in making the policy towards the supply of cement. However, before discussing the findings of the study, the section 2 will briefly review previous studies relevant to this study. Section 3 outlines the research method. In this section a particular concern on the
dynamic systems model and the source of data will be detailed. Section 4, then, discussed the finding of the study. Finally, section 5 will address concluding remarks and recommendation of the study.

II. LITERATURE REVIEW

As has been mentioned at the outset that the study to estimate the future supply of cement for construction industries in the province of Banten was limited. The available studies relevant to this present study is as follows. The first study is the study undertaken by Rahayu Utami (2006) titled Dynamic System Simulation toward the availability of cassava in Bogor, West Java. The second is the study conducted by Erma Suryani (2005) on the Policy Planning scenario towards the capacity of the cement industry using Dynamic system model. The third is the study done by Safitri Ambarsari, et.al. (2015) on the Analysis of Work Core Process of Supply Chain using Lean Six Supply Chain Management in Semen Indonesia company (Persero) Tbk. The fourth study is the study on the Supply Simulation of Maize using the Dynamic Systems Approach in Chareon Pokhpand company in Indonesia. This study was conducted by Alkafi Abdillah (2014). The other relevant study that needs to be informed is the study conducted by EkoWidodo, et.al. (2013). This study was focused on the Dynamic Systems Simulation to Improve supply Performance of the company in Indonesia. The mentioned studies confirmed that there were no available studies on the Dynamic Systems Simulation of the Supply of Cement in the province of Banten.

III. RESEARCH METHODS

Dynamic System Model

As discussed previously that cement is one of the raw materials that need to be provided adequately toward the development of infrastructures. However, the supply availability of cement in many regions in Indonesia was considered limited. The reason is simply because efforts to supply cement in the region deal with many complex factors or variables. To solve this problem, a dynamic system model was suggested in the literature. This model is considered able to deal with the complexity of the variables associated with the supply of cement.

The used of system approach begins with problems identification, and followed by the needs analysis and ends by the effective operating system. The system approach has several elements including their methodologies for planning and management which have be multidisciplinary and systematic approaches. This approach should also be able to think in non-quantitative, by using mathematical modelling, simulation and optimization technique. This approach can also be applied using computer (Eriyatno, 1998).

There are at least three stages that need to be done using the system approach. The first is the stage of needs analysis. This includes the department of Public Works, Regional Development Planning organization (Bappeda), and other stake holders including the cement industries and consumers. Having completing this need analysis, the second stage will be problems formulation. In this stage there will be problems formulation towards the development of the cement industry Supply Chain system. However, in this stage there are usually many problems associated with the Supply Chain system of cement. These problems include the problem of the transport system from the distributor to the consumer, and the fluctuations of the price of cement in the industrial market. These problems will affect the cement industry to run the business.

After completing the problems formulation, there is a need to identifying the system itself. In this stage, the analysis needs to focus a chain of relationships between the statement of needs and a special statement of the problem that need to be solved to meet these needs. In this part the analysis needs to consider the interests of the components involved and the linkage components in the system using casual loops (Muhamadi, et.al., 2001).

In modelling dynamic system, the study first conceptualizing the model. In this stage, there should be an understanding of the system that is going to be modelled based on the concept used. This aims to obtain the overall picture of the model that is going to be made. This phase begins with identifying all critical components involved or which will be incorporated into the model and set the model boundaries. The inter relationship of the components are then searched one and another using a causal diagram. The arrows in the diagram marked with (+) or (-) depending on the relationship that occurs whether positive or negative. Sign (+) is used to express the relationship between the two factors that change in the same direction. While the sign (-) is used if the relationship between these two factors change in different direction.
This is then followed by the phase of model formulation. In this phase the true meaning of every relationship that exists in the conceptual model is formulated. This dynamic system will use mathematical equations (differential equations) to describe a system into the model. At this stage the quantification of the model is done by incorporating the quantitative data into a dynamic system diagram in order to obtain the corresponding relationship between the variables in the model consistently.

Finally, it is the stage of model evaluation. In this stage there should be verification and validation of the model. Verification is performed to determine the consistency of the model made by checking the dimensions of the variables used in the model and determine the accuracy of the use of methods of integration (time step) that are selected. Whilst validation is done by comparing the model simulation with the real situation. Validation includes direct structure tests without running the models, and comparing test of the model behaviour with quantitative behaviour pattern.

In organising the model, there are four stages that needs to be given attention. The first is problem identification. Problems associated in this stage include the existence of a fairly complex problems, many variables involved, and time. To clarify the scope of the problem, it is required restrictions on the problem and used the relevant assumptions in building the model. Some of the necessary variables include the total initial value of cement productivity, the amount of cement consumption, and cement industrial capacity.

The second is data collection techniques. The data collection is aimed to collect a variety of data and information related to the cement industry, cement supply chain activities, including the activities of the process of supply, production to distribution. Data that are needed include primary and secondary data which contains the following. The primary data include: 1) the supply chain of the existing condition of the cement in Indonesia in general and in the study area, especially through direct observation in the field survey and interview process with the stakeholders. 2) Historical data of the Indonesian cement production, historical data of cement sales, historical data on cement consumption, historical data in the study area of cement production, historical data of cement consumption in the study area, and the data of infrastructural development plan.

The secondary data that needs to be collected include those obtained from the literature and from related agencies. Other secondary data needed include the data of demand for cement in the province of Banten, construction project planning data, and other supporting data. These secondary data was collected from the Indonesian Cement Association, the Central Bureau of Statistics at provincial level, the ministry of public works in Banten and National Planning Agency (BAPENAS).

The third stage is making the Model and Simulation. Modelling, simulation and analysis need to be conducted in accordance with the goals, objectives, and the scenario. Before running the simulation, it is necessary to put the values of the required parameters. The initial value of the variables studied, the fraction or parameters and effect link between a variable with a significant other variables that are determined based on empirical data and information that can be gathered from sources and relevant literatures.

Finally, the stage of model verification and validation. In model verification, there is need to check an recheck the unit size to the variables in the models. This includes the level, rate and the constants of secondary data, and then determines the accuracy of the use of methods of integration and the time step chosen, and asked stakeholders to evaluate the model created. While the model validation was carried out in accordance with the purpose of modelling to compare the dynamic behaviour of the model with the real system conditions. If the model has been deemed valid, then this model can be used as a representative model.

**Model Design**

In designing the model there are three steps taken. The first is by describing the dynamic system model. In this model design, the analysis will be limited only to matters relating to the supply and demand of cements used for the raw materials that are needed for the construction industry. Any problems associated with the supply and demand for cements are analysed using the causal loop approach which formulated in the stock and flow diagram, and further simulated using Software Powersim Studio2005.

The second is conceptualizing the model. This conceptualisation is done to analyze the availability system of cement by using simulation technique in accordance with the problems that are further going to be solved by the policy makers. This simulation technique was made based on replication of the real system into a sub-system or sub-models. In this sub model, the availability of cement is assumed to be influenced by annual cement production and consumption of cement per year. The causal relationship between variables in the sub model of the production and consumption of cements is described by the causal loops diagram.
Note that, in constructing the casual loop diagram, Powersim 2.5 software program is used. The data that are accommodated in this software are both production and consumption of cements in Banten. The data period used was from 2003 to 2013. The production data were taken from the following cement industries. These are PT. Semen Padang (PT, SP), PT. Indocement Tunggal Tbk (PT. ITP), PT. Semen Balfour (PT, SB), PT. Holcim Indonesia Tbk (PT, HI), PT. Semen Gresik (PT, SG), PT Semen Bosowa Maros. (SBM), while the consumption data was divided into cement consumption for construction and non-construction.

The third is model formulation. However, before formulating the model, the following assumptions need to be mentioned. First, the availability model built should be applicable to both construction and non-construction. Second, the cement industries analysed are those in the group of Indonesian Cement Association. Third, the data for cement consumption were limited to cement consumption for constructional purposes in Banten. Fourth, the growth rate of the project was held constant over the period 2004-2025. Fifth, the period of simulation analysis is limited to the period of 2003 to 2025. Finally, it is assumed that the total cement industry was considered fixed during 2003-2013. Note that, before formulating the model, data on the types of distributional patterns are analysed using Promodel Software 7.5 programs.

In the context of the sub model of the cement availability, the study used the following mathematical equations.

• Historical Data of Cement = NORMAL (2.22317 million tons <<>>; 641 070 tons <<>>) where, historical data of cement = normal distribution of cement production in scale year (tons)

• cement consumption data = NORMAL (2.21146 million tons <<>>; 643 820 tons <<>>) where, historical data of cement = normal distribution of cement consumption.

The above equations are the equations to determine the need or the amount of cement required for supporting both construction and non-construction projects. The value of production is based on data from the Indonesian Cement Association in the periods of 2003-2013, while for consumption used data for both construction and non-construction obtained from the result of the normal distribution using the software Promodel 7.5.

Furthermore, in the analysing the availability of cement using dynamic system, the model design, simulation and analysis were conducted in accordance with the objectives and scenarios on the model. Policy scenarios that will be used in the analysis of cement available in Banten province used the following scenario. First, a scenario with no change in policy that describes the condition of the production and consumption of cement during the period of 2003-2013 where there was a tendency of dynamic data or random. Under these conditions then it was predicted the situation in the future. In this model it is assumed there are no expansion on production capacity to improve productivity. This situation illustrates the state without the addition of a new plant. With this model it can be analyzed situations and behaviour of the availability of cement system in the province of Banten in the absence of policy changes or additions to the new cement industry.

IV. RESULTS AND DISCUSSION

The General Conditions Cement Industry

Detail of production, consumption and capacity of the cement industry in Indonesia can be seen in Table 1. As can be seen at this Table that there had been an increase of production as well as consumption of cement in Indonesia. However, in terms of trade, there have been deficit of cement in Indonesia between the period of 2009 and 2013 as the data available. This suggests that the local production of cement in Indonesia relatively has been limited to fulfil the demand for cement. Therefore, the government plays important role in bridging the increasing demand of cement in Indonesia.

Table 1. Production, Consumption and Capacity of Cement Industry in Indonesia

<table>
<thead>
<tr>
<th>Description</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>45,857.1</td>
<td>49,155.2</td>
<td>54,154.2</td>
<td>55,714.2</td>
<td>58,199.20</td>
</tr>
<tr>
<td>Import</td>
<td>1,672.8</td>
<td>2,077.0</td>
<td>2,159.8</td>
<td>3,730.5</td>
<td>5,282.10</td>
</tr>
<tr>
<td>Export</td>
<td>1,649.1</td>
<td>2,563.1</td>
<td>2,067.4</td>
<td>48.2</td>
<td>936.7</td>
</tr>
<tr>
<td>Consumption</td>
<td>45,880.8</td>
<td>48,669.1</td>
<td>54,246.5</td>
<td>58,964.5</td>
<td>62,544.60</td>
</tr>
<tr>
<td>Capacity</td>
<td>52,250.4</td>
<td>55,150.5</td>
<td>59,185.3</td>
<td>62,122.2</td>
<td>65,385.00</td>
</tr>
<tr>
<td>Utility</td>
<td>87.8</td>
<td>89.1</td>
<td>91.5</td>
<td>89.7</td>
<td>89.0</td>
</tr>
<tr>
<td>Domestic Market Power</td>
<td>96.4</td>
<td>95.7</td>
<td>96.0</td>
<td>93.7</td>
<td>91.6</td>
</tr>
</tbody>
</table>
In the province of Banten the expenditure of industrial construction per year between the period 2013-2014 continued to increase to reach 11.8 trillion rupiah. Judging from the type of work, nearly 60 per cent of the construction value is the result of the work of civil building construction such as the construction / repair of roads and bridges. The used of cement for construction in this province was about 6 percent of the total national cement production in 2013. Details production and consumption of cement in the province of Banten can be seen at Table 2.

Table 2. Production and Consumption of cement in Banten, 2003-2013

<table>
<thead>
<tr>
<th>Year</th>
<th>National Production (tons)</th>
<th>Production in Banten (tons)</th>
<th>Percentage of Cement production in Banten of the national production</th>
<th>Consumption of Cement in Banten (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>27,539,018</td>
<td>1,400,434</td>
<td>5.09</td>
<td>1,387,189</td>
</tr>
<tr>
<td>2004</td>
<td>30,208,479</td>
<td>1,768,082</td>
<td>5.85</td>
<td>1,755,914</td>
</tr>
<tr>
<td>2006</td>
<td>31,975,265</td>
<td>1,877,605</td>
<td>5.87</td>
<td>1,870,801</td>
</tr>
<tr>
<td>2007</td>
<td>34,172,436</td>
<td>1,977,810</td>
<td>5.79</td>
<td>1,974,367</td>
</tr>
<tr>
<td>2008</td>
<td>38,071,617</td>
<td>2,039,541</td>
<td>5.36</td>
<td>2,015,265</td>
</tr>
<tr>
<td>2009</td>
<td>39,050,918</td>
<td>1,837,419</td>
<td>4.71</td>
<td>1,824,526</td>
</tr>
<tr>
<td>2010</td>
<td>40,777,865</td>
<td>2,005,185</td>
<td>4.92</td>
<td>1,988,743</td>
</tr>
<tr>
<td>2011</td>
<td>47,999,893</td>
<td>2,779,158</td>
<td>5.79</td>
<td>2,762,497</td>
</tr>
<tr>
<td>2012</td>
<td>54,969,478</td>
<td>3,186,377</td>
<td>5.80</td>
<td>3,181,169</td>
</tr>
<tr>
<td>2013</td>
<td>58,023,626</td>
<td>3,474,591</td>
<td>5.99</td>
<td>3,472,432</td>
</tr>
</tbody>
</table>

Source: Indonesian Cement Association, various years.

The use of cement as a raw infrastructure material in Banten

Construction sector plays an important role in the economic development process, especially to support the creation of economic and social infrastructures in a region and to stimulate the growth of other economic sectors. The number of construction companies in Banten during the period 2013-2014 increased from 2,413 units to 2,440 units. However, the increase of the number of companies was not followed by the increase in the number of permanent workers. During these years, the number of workers reduced from 25 335 workers to 24 967 workers (Table 3). This indicates that the growing number of construction company does not always contribute to the increase of the number of workers. Thus, much remain to be done to push the use of workers by the construction companies.

Table 3. The number of Construction Companies in Banten, 2013-2014

<table>
<thead>
<tr>
<th>Description</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number of Construction companies</td>
<td>2,413</td>
<td>2,444</td>
</tr>
<tr>
<td>The number of workers</td>
<td>25,335</td>
<td>24,967</td>
</tr>
<tr>
<td>Constructional values (billion Rupiah)</td>
<td>10,904</td>
<td>11,799</td>
</tr>
</tbody>
</table>

Source: Provincial Statistic Bureau, 2015.

It should be noted that the construction companies that grew in Banten from 2013 to 2014 were mostly working on various projects. These projects were funded by the provincial financial sources as well as district / city government funds. This condition indicated the dominant source of funding of construction work coming from local funds. The percentage of funding from budget funds during these periods ranged from 62.6 percent to 70.5 percent of the total value of the completion works. Details of the use of local budget for infrastructure in Banten in 2015 are sown at Table 4.
Table 4. Budget Allocation for Infrastructures in Banten, 2015

<table>
<thead>
<tr>
<th>Unit : Million Rupiah</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Public Works</td>
</tr>
<tr>
<td><strong>Housing development Programs</strong></td>
</tr>
<tr>
<td>Housing Monitoring, controlling, and implementation</td>
</tr>
<tr>
<td>Management of Official Buildings and Housing</td>
</tr>
<tr>
<td>Sanitation and Waste Management</td>
</tr>
<tr>
<td>Drinking Water system Management</td>
</tr>
<tr>
<td>Policy and program Formulation, International Cooperation and Data Information</td>
</tr>
<tr>
<td><strong>Road Construction Program</strong></td>
</tr>
<tr>
<td>Capacity Development and Preservation of National Roads</td>
</tr>
<tr>
<td>Regional Spatial Planning</td>
</tr>
<tr>
<td>Regional Spatial Plan Implementation</td>
</tr>
<tr>
<td>National Plan Implementation</td>
</tr>
<tr>
<td>City Development Plan</td>
</tr>
<tr>
<td>Spatial Development Plan</td>
</tr>
<tr>
<td><strong>Water Management Program</strong></td>
</tr>
<tr>
<td>Irrigation Development and Management</td>
</tr>
<tr>
<td>Natural Disaster Management</td>
</tr>
<tr>
<td>Water Integrated management</td>
</tr>
<tr>
<td>Conservation and Development of Dams</td>
</tr>
<tr>
<td>Water supply and management</td>
</tr>
</tbody>
</table>


**The Cement Industries in Banten**

There are three types of the cement industries in the province of Banten. These are Indonesian Cement Association (ASI), PT Cemindo Gemilang (White Cement Industries), and PT Semen Hippo. The Indonesian Cement Association was founded on October 7, 1969 and consisted of two state-owned cement plants that exist at the time as the P.N. Semen Padang and P.N. Semen Gresik. Indonesian Cement Association was originally established as a forum for communication, consultation and coordination for the purposes of cooperation between its members in developing the cement industry both in terms of production, quality, marketing, research and development as well as in other matters where deemed necessary by the members, society and the State. Details of the supply of cement produced by the member companies of this association are shown at Table 5.

Table 5. Cement Production Produced by Cement Companies under ASI, 2003-2013

<table>
<thead>
<tr>
<th>Years</th>
<th>PT. SP</th>
<th>PT. SB</th>
<th>PT. ITP</th>
<th>PT. HI</th>
<th>PT.SG</th>
<th>PT SBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>16,665</td>
<td>80,950</td>
<td>829,193</td>
<td>215,123</td>
<td>258,503</td>
<td>-</td>
</tr>
<tr>
<td>2004</td>
<td>40,581</td>
<td>88,911</td>
<td>907,246</td>
<td>328,587</td>
<td>402,770</td>
<td>-</td>
</tr>
<tr>
<td>2005</td>
<td>107,308</td>
<td>94,511</td>
<td>918,893</td>
<td>388,732</td>
<td>501,462</td>
<td>97,800</td>
</tr>
<tr>
<td>2006</td>
<td>165,383</td>
<td>69,634</td>
<td>780,444</td>
<td>313,504</td>
<td>419,984</td>
<td>128,656</td>
</tr>
<tr>
<td>2007</td>
<td>157,728</td>
<td>44,921</td>
<td>976,213</td>
<td>385,365</td>
<td>305,904</td>
<td>107,679</td>
</tr>
<tr>
<td>2008</td>
<td>225,567</td>
<td>3,462</td>
<td>1,804,843</td>
<td>443,268</td>
<td>242,016</td>
<td>40,385</td>
</tr>
<tr>
<td>2009</td>
<td>251,137</td>
<td>18,404</td>
<td>1,001,731</td>
<td>348,109</td>
<td>216,709</td>
<td>233,521</td>
</tr>
<tr>
<td>2010</td>
<td>198,210.71</td>
<td>8,205</td>
<td>1,153,184</td>
<td>383,282</td>
<td>258,936</td>
<td>3,367</td>
</tr>
<tr>
<td>2011</td>
<td>223,732.85</td>
<td>1,800</td>
<td>1,490,213</td>
<td>543,528</td>
<td>483,005</td>
<td>36,877</td>
</tr>
<tr>
<td>2012</td>
<td>307,182</td>
<td>-</td>
<td>1,600,362</td>
<td>648,134</td>
<td>553,429</td>
<td>72,270</td>
</tr>
<tr>
<td>2013</td>
<td>416,128.62</td>
<td>-</td>
<td>1,650,918</td>
<td>600,476</td>
<td>785,968</td>
<td>21,100</td>
</tr>
</tbody>
</table>


PT.Cemindo Gemilang is the holder of the Red and White Cement brand was founded in 2011. In order to provide quality raw materials for the country, the current PT. Cemindo Gemilang build an integrated plant in the area Bayah, Banten, with a clinker production capacity of 10,000 tons per day, equivalent to production of 4 million tons of cement per year. In addition to
building an integrated cement factory in the area Bayah, PT. Cemindo Gemilang also have a grinding plant in the area Ciwandan, Banten, with a two-line production capacity of 750,000 and 1,000,000 tons years.

PT. Cement Hippo or PT. Sun Fook Industries Indonesia are companies manufacturing cement with trademark CEMENT HIPPO which was established on 22 January 2013, with the aim to meet the demand for high-quality cement in Indonesia. This company has adopted the Quality Management System ISO 9001: 2008 as a standard procedure Operation. This company was able to maximize production capacity to reach 1.2 million tons per year. Note that in this paper, PT. Hippo cement is not included in the study analysis.

The Analysis of Cement Production and Consumption

Using the dynamic system model, it was found that the production of cement are distributed normally which have mean value of 2.223.170 and the standard deviation of 641.070 (Table 6).

Table 6. Automatic Fitting of Cement Production using ProModel Software Program

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Rank</th>
<th>Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lognormal(1.3e+006, 0.791)</td>
<td>100</td>
<td>do not reject</td>
</tr>
<tr>
<td>Normal(2.2e+006, 6.1e+005)</td>
<td>21.7</td>
<td>do not reject</td>
</tr>
<tr>
<td>Exponential(1.9e+006, 8.2e+005)</td>
<td>10.9</td>
<td>do not reject</td>
</tr>
<tr>
<td>Uniform(1.4e+006, 3.4e+006)</td>
<td>1.81</td>
<td>do not reject</td>
</tr>
</tbody>
</table>

In terms of the cement consumption, it was found that the cement consumption are also normally distributed with a mean value of 2.21146 and standard deviation of 643.820 (Table 7). Note that the normal distribution is a bell-shaped function with parameter μ (mean) and σ (standard deviation). Normal random variables used to model many random phenomenon that can be expressed as the number of random variables, based on the central limit theorem. The analysis should be careful in using the normal distribution to model random phenomena which cannot assume a negative value. The normal distribution is generally used to describe process, while model formulation model is a formulation of the problem into mathematical form to represent the real system. Model formulation links variables that have been identified in the conceptual model with symbolic language.

Table 7. Automatic Fitting cement consumption using Promodel 7.5 software program

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Rank</th>
<th>Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lognormal(1.29e+006, 13.5, 0.291)</td>
<td>100</td>
<td>do not reject</td>
</tr>
<tr>
<td>Normal(2.21e+006, 6.14e+005)</td>
<td>21.7</td>
<td>do not reject</td>
</tr>
<tr>
<td>Exponential(1.93e+006, 8.24e+005)</td>
<td>1.7</td>
<td>do not reject</td>
</tr>
<tr>
<td>Uniform(1.39e+006, 3.47e+006)</td>
<td>1.49</td>
<td>do not reject</td>
</tr>
</tbody>
</table>

The result using simulations under the scenario of no policy change was shown in Table 8. It can be seen that in 2014-2025 the production of cement is going to be fluctuated. This suggests that the cement consumption in these periods cannot be met. However, this finding is subject to the condition that the physical infrastructure development projects in the province Banten will be in accordance with the Medium Term Development Plan (RPJMD) of Banten Province between the year 2012 and 2017. This RPJMD is called specifically as the Development of Growth Centre and Strategic Area. These development 'doorway' Banten consists of (1) Soekarno-Hatta International airport, (2) International hub port of Bojonegara, and (3) the settlement area.
of large-scale Maja, the construction of International Port Bojonegara, and the construction of the Sunda Strait Bridge. Table 8 shows the simulation results of the cement production from the year 2003 to 2015.

Table 8. The Result of Simulation of the cement Production, 2003-2015 (unit: tons)

<table>
<thead>
<tr>
<th>Year</th>
<th>The consumption of cement</th>
<th>The production of Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>3,050,507.57</td>
<td>2,097,740.44</td>
</tr>
<tr>
<td>2004</td>
<td>3,043,730.87</td>
<td>1,809,041.12</td>
</tr>
<tr>
<td>2005</td>
<td>2,002,908.18</td>
<td>1,112,391.42</td>
</tr>
<tr>
<td>2006</td>
<td>2,245,589.13</td>
<td>2,777,194.44</td>
</tr>
<tr>
<td>2007</td>
<td>817,001.77</td>
<td>2,712,010.18</td>
</tr>
<tr>
<td>2008</td>
<td>3,334,073.76</td>
<td>2,538,801.02</td>
</tr>
<tr>
<td>2009</td>
<td>2,640,784.10</td>
<td>2,793,890.95</td>
</tr>
<tr>
<td>2010</td>
<td>3,022,189.22</td>
<td>1,977,037.49</td>
</tr>
<tr>
<td>2011</td>
<td>2,004,151.45</td>
<td>2,580,400.02</td>
</tr>
<tr>
<td>2012</td>
<td>1,502,185.24</td>
<td>2,071,595.78</td>
</tr>
<tr>
<td>2013</td>
<td>1,750,954.49</td>
<td>653,390.50</td>
</tr>
<tr>
<td>2014</td>
<td>1,770,954.49</td>
<td>2,324,350.91</td>
</tr>
<tr>
<td>2015</td>
<td>1,825,122.81</td>
<td>3,281,947.32</td>
</tr>
<tr>
<td>2016</td>
<td>3,004,524.02</td>
<td>1,403,483.87</td>
</tr>
<tr>
<td>2017</td>
<td>1,454,342.09</td>
<td>2,950,115.07</td>
</tr>
<tr>
<td>2018</td>
<td>1,572,080.40</td>
<td>2,428,539.11</td>
</tr>
<tr>
<td>2019</td>
<td>2,026,029.71</td>
<td>1,081,343.02</td>
</tr>
<tr>
<td>2020</td>
<td>2,155,122.00</td>
<td>3,541,402.04</td>
</tr>
<tr>
<td>2021</td>
<td>3,122,529.44</td>
<td>2,001,231.13</td>
</tr>
<tr>
<td>2022</td>
<td>2,023,825.50</td>
<td>1,748,089.18</td>
</tr>
<tr>
<td>2023</td>
<td>2,941,710.03</td>
<td>3,593,825.44</td>
</tr>
<tr>
<td>2024</td>
<td>2,099,252.98</td>
<td>1,619,945.91</td>
</tr>
<tr>
<td>2025</td>
<td>3,109,329.24</td>
<td>1,950,563.12</td>
</tr>
</tbody>
</table>

Source: estimated by using Powersim for windows 2005.

To validate the model, the application of statistical method was used. This was done by comparing model output (simulation results) with the actual data. The statistical test used was Paired simple t-test. This test can be categorized as parametric statistical group that can be used in testing the hypothesis and to determine whether there is a significant difference of the actual data and the results of the simulation.

If the results of the simulation showed: (a) t-value is more than t-table (-0.523 <- 2.228) at the level of 5 percent, then H0 is accepted. This means that there is no difference between the average value of the actual cement consumption with the average consumption of cement simulation. Moreover, if the t value is more than t-table (0.351 < 2.228) at the level of 5 percent, then H0 is accepted. This means that there is no difference between the average value of the actual cement production with an average of the simulation of cement production.

In terms of cement consumption, the results of simulation towards the cement consumption based on the fiscal budget of Banten, the study found the following results as shown at Table 9. Note that, the data are estimated by multiplying the fiscal value of the province in 2015 and the results of the analysis of cement consumption in the periods 2016-2025.

Table 9. Cement Consumption towards development in Banten Province, 2016-2025

<table>
<thead>
<tr>
<th>Year</th>
<th>Housing Infrastructural Programs</th>
<th>Road Development Programs</th>
<th>Water Resources Development Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>707,905.04</td>
<td>965,325.06</td>
<td>1,391,293.90</td>
</tr>
<tr>
<td>2017</td>
<td>335,953.00</td>
<td>458,117.73</td>
<td>660,221.27</td>
</tr>
<tr>
<td>2018</td>
<td>363,150.48</td>
<td>495,205.20</td>
<td>713,724.32</td>
</tr>
<tr>
<td>2019</td>
<td>468,151.30</td>
<td>638,388.14</td>
<td>920,089.57</td>
</tr>
<tr>
<td>2020</td>
<td>497,833.18</td>
<td>678,863.43</td>
<td>978,425.39</td>
</tr>
<tr>
<td>2021</td>
<td>721,304.20</td>
<td>983,596.64</td>
<td>1,417,628.17</td>
</tr>
<tr>
<td>2022</td>
<td>467,503.58</td>
<td>637,504.88</td>
<td>918,816.60</td>
</tr>
<tr>
<td>2023</td>
<td>679,535.01</td>
<td>926,638.65</td>
<td>1,335,536.34</td>
</tr>
<tr>
<td>2024</td>
<td>484,927.21</td>
<td>661,264.38</td>
<td>953,060.41</td>
</tr>
<tr>
<td>2025</td>
<td>732,114.99</td>
<td>998,338.64</td>
<td>1,438,875.37</td>
</tr>
</tbody>
</table>

Source: estimated by using Powersim for windows 2005.
V. CONCLUDING NOTES

The results of the dynamic system model simulation confirm that the cement production is influenced by historical data of the cement industry as well as cement consumption data used for both construction and non-construction purposes from 2003-2013 year. However, in terms of the cement production, the study indicated that in 2014-2025 the production of cement will be fluctuated. This fluctuation is estimated to be unable to meet the cement consumption in these years.

To improve the above estimated results of dynamics system model, further studies need to accommodate other variables including the rate of production, production capacity, exports, inflation, exchange rate, growth rate of construction projects, economic growth, global economic and population growth. The inclusion of these variables in the dynamic system model will give a better estimation. In addition, there is also a need to update the period under estimation from the period of 2003-2015 to the period of 2005-2015. Also, there is a need to specify location under study from the provincial level to the city or districts level. This is mainly because a simulation technique using dynamics model at the provincial level needs many assumptions. Therefore, caveat applies towards the findings of this study.

However, this study can be used as the starting point in estimating the future needs of cement production in the province of Banten. Based on the findings, the study suggests the following. First, there is a need to increase the number of cement industries in the province of Banten. Second, the provincial government should introduce conducive policies to attract investors to invest in cement industries to support the sustainability of cement production. Third, the increase of cement industries should be environmentally friendly. Fourth, there is a need to develop a large capacity of cement production. Finally, the government needs to monitor the availability of cements to mitigate the gap between the supply and demand of cements in this region. Thus, much remain to be done by the government of the province of Banten to sustain the availability of cement for infrastructural development.

REFERENCES


http://www.bappenas.go.id/id/id/ [4 April 2016, 20.00 WIB]

http://www.semenindonesia.com [27 Maret 2016, 14.00 WIB]

http://www.bantenprov.go.id [15 Maret 2016, 17.00 WIB]
Environmental effects and aspects of LD slag

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¹ Asst. Professor, Department of Metallurgical Engineering BIT Sindri;
²,³,⁴ Students of Final year Department of Metallurgical Engineering, BIT Sindri.

Abstract - It is important regarding environmental consideration to reuse the waste generated in steel plants. LD slag is mainly composed of calcium, silicon, iron and phosphorus but also contains trace amounts of potential toxic elements, specifically Cr and V which can be released. Although if directly discharged LD slag has negative impact on environment but it can be utilized judiciously to impart benefit to the environment by different ways mentioned in the paper. Moreover LD slag can be used as the base material or by material for the civil purposes, fertilizers etc. reducing environmental impacts.

Index Terms - effect on soil, effect on water bodies, future aspects.

I. INTRODUCTION

Integrated steel plants generate many types of wastes at different stages of the processing. Utilization of waste is an environment friendly cost saving technique. Generation rate of LD-slag is 150-180 kg per ton of crude steel. CaO is an important oxide present in the slag which can be utilized in other metallurgical processes as flux material instead of lime or lime stone. The phosphorus of BOF or LD slag is too high to be reused in iron making and steel making. Blast furnace slag has a long term market in cement fertilizer and construction industries, whereas LD slag is not suitable due to its high phosphorous content. The most economic, environment friendly and efficient option for metallurgical waste utilization is through proper recycling. Efficient utilization of large quantity of waste slag is very important not only from economic point of view but environmental aspect also.

II. LITERATURE REVIEW

The lands occupied by landfills loses its fertility and are considered degraded and cannot be used for the agriculture. The industrial waste landfills are sometimes placed in the inappropriate place[1]. Slag mountains are formed by dumping which not only harms the acquired space but also blocks the space for its use, as the population is increasing day by day so space is also a matter of fact in the upcoming time. It’s the responsibility of industries to mitigate the harmful effects of dumping of the slag.

Effect on soil quality and its improvement purpose:

Although researchers are working to utilize the LD-slag as base material for bolder, road making, cement etc [1]. It can directly be utilized for the environment conditioning only if used in a proper way. Dumping of LD slag directly to an area will increases the metallic,lime and phosphorus content in the soil harming its quality. The composition of LD slag is shown in the table below:
TABLE 1: Composition of several phases in LD slag[2]

<table>
<thead>
<tr>
<th>Mineral phase</th>
<th>CaO</th>
<th>SiO₂</th>
<th>FeO</th>
<th>Mn</th>
<th>MgO</th>
<th>P₂O₅</th>
<th>Al₂O₃</th>
<th>TiO₂</th>
<th>Cr₂O₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dicalciumsilicate</td>
<td>58.00</td>
<td>33.84</td>
<td>0.54</td>
<td>-</td>
<td>0.01</td>
<td>3.62</td>
<td>0.67</td>
<td>0.50</td>
<td>0.04</td>
</tr>
<tr>
<td>Tricalcium silicate</td>
<td>68.20</td>
<td>25.70</td>
<td>2.15</td>
<td>1.55</td>
<td>0.08</td>
<td>1.10</td>
<td>0.30</td>
<td>0.37</td>
<td>-</td>
</tr>
<tr>
<td>Dicalcium ferrite</td>
<td>49.64</td>
<td>1.48</td>
<td>48.11</td>
<td>0.36</td>
<td>4.24</td>
<td>0.02</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dicalciumferrit etitanate</td>
<td>52.70</td>
<td>2.55</td>
<td>33.31</td>
<td>0.88</td>
<td>0.43</td>
<td>0.32</td>
<td>3.25</td>
<td>8.53</td>
<td>0.39</td>
</tr>
<tr>
<td>MagnesioWustite</td>
<td>2.12</td>
<td>2.08</td>
<td>61.80</td>
<td>17.50</td>
<td>5.68</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Process for removal of metallic content, so that the amount of the metallic value of soil do not increase[3] :
Different authors have gone through physical processes like magnetic separation, flotation, dual phase separation etc. Particles with high magnetic susceptibility will be separated by a light magnetic field and weaker magnetic particles will be separated by a strong magnetic field. Therefore, the heterogeneous magnetic field of different intensities can separate different particles. However, this is not a very effective way of dephosphorisation.

We can use LD Slag for soil conditioning by the recovery of the phosphorus in the following ways:

Physical process[4]
Scientist studied the removal of phosphorus from LD slag by floating separation of Dicalcium Silicate during solidification. On slow cooling from high temperature the slag is separated in two layers, CaO, SiO₂ and P₂O₅ are segregated in the top layer and FeO, Fe₂O₃ and MnO in the bottom layer.

Chemical process[5]
Pyro metallurgical treatment of LD-slag was done by different investigators. Scientist proposed a method in which phosphorus is removed through evaporation by adding silicon to a Fe-P-C alloy obtained because of reduction of slag with carbon. The overall reaction can be represented by:
3CaO.P₂O₅(s) + 5C + 3SiO₂ = 3(CaO.SiO₂) + 5CO + P₂(g)

Physico-chemical method[6-9]
LD-converter slag produced in a 170-t LD-converter at Nippon Steel's Sakai works under various blowing conditions were used for the experiments. Samples were prepared by crushing 10kg of lump slag to below 3mm pulverising to less than 100mesh. Different components of samples were estimated by fluorescent X-ray analysis. The slag has been superheated to 1923K and slowly cooled to lower temperature then at room temperature, the mineral phases were identified by microscopic and EPMA examination. As a result of slow cooling, CaO, SiO, and P₂O₅ are enriched in top and FeO, Fe₂O₃ and MnO in bottom. Analysis of top and bottom layer of slag is shown in Table below. They went to the conclusion that dicalcium silicate is apt to separate more efficiently with higher total iron content in slag and at higher start temperature of cooling, close to liquidus temperature. Blowing oxygen into the molten slag before cooling can improve the efficiency of separation.

<table>
<thead>
<tr>
<th></th>
<th>FeO</th>
<th>CaO</th>
<th>SiO₂</th>
<th>MnO</th>
<th>MgO</th>
<th>P₂O₅</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>14.0</td>
<td>47.6</td>
<td>18.5</td>
<td>3.0</td>
<td>4.1</td>
<td>3.14</td>
</tr>
<tr>
<td>Bottom</td>
<td>29.2</td>
<td>34.9</td>
<td>7.1</td>
<td>5.9</td>
<td>5.6</td>
<td>0.96</td>
</tr>
</tbody>
</table>

While,
%P = %P₂O₅ * 0.44

Now the recovered phosphorus can be used in fertilizer industries. According to the conventional fertilizer standards a 100 pound bag of 10-10-10 fertilizer contains 10% P₂O₅. In the year 2016-2017 production of Tata Steel is 10.5MTPAas per its yearbook. Generation rate of LD Slag is 150 – 180 kg per ton of steel. While P₂O₅ is 1-3% of slag. It means for the production of 1 ton of steel we will get 1.5 – 5.4 kg of P2O5.
By the simple calculation above it can be seen that a huge amount of \( \text{P}_2\text{O}_5 \) can be produced and used in the fertilizer formation.

As per the report based on P fertility status of soils in India and 9.6 million soil test summaries, 49.3\% of district are in low phosphorus category while 48.80\% are medium and 1.9\% is high in P category. It is shown by the Table2.

<table>
<thead>
<tr>
<th>STATE/UNION TERRITORY</th>
<th>No. of districts for which soil tests were obtained</th>
<th>fertility classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
<td>medium</td>
</tr>
<tr>
<td>ANDHRA PRADESH</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>ARUNACHAL PRADESH</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>ASSAM</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>BIHAR</td>
<td>26</td>
<td>12</td>
</tr>
<tr>
<td>CHANDIGARH</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>DADAR AND NAGAR HILLS</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>DELHI</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>GOA</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>GUJARAT</td>
<td>19</td>
<td>14</td>
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<tr>
<td>HARYANA</td>
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<td>2</td>
</tr>
<tr>
<td>HIMACHAL PRADESH</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>JAMMU AND KASHMIR</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>KARNATAKA</td>
<td>19</td>
<td>16</td>
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<td>45</td>
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<td>1</td>
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<td>MEGHALAYA</td>
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<td>MIZORAM</td>
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<td>NAGALAND</td>
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<tr>
<td>ORISSA</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>PONDICHERRY</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>PUNJAB</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>RAJASTHAN</td>
<td>26</td>
<td>2</td>
</tr>
<tr>
<td>TAMIL NADU</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>UTTAR PRADESH</td>
<td>55</td>
<td>41</td>
</tr>
<tr>
<td>WEST BENGAL</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>Tripura</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>363</td>
<td>179</td>
</tr>
</tbody>
</table>

**TABLE2: Distribution of districts and Union territories according to the available P in soil.**

As the major part of Indian economy is based on agriculture so to promote the Indian agriculture we can use LD Slag, phosphorus plays vital role in crop growth such as rice, corn, wheat, tobacco etc. Phosphorus is an essential requirement in rice farming as it promotes rapid tillering, root development and early flowering. If P is deficient damage occurs to the plant.
FIG. 01   a. Crop devoid of Phosphorus             b. Crop having sufficient amount of phosphorus

After the removal of the phosphorus content to a lower amount the LD Slag can be used to increases the basicity due to high CaO content to manage acidity of the soil.

Effect on aquatic life:

Direct discharge to the area near to the water bodies can cause contamination. Minerals are the essential component required for the growth of the aquatic life. “Oligotrophication”[11], characterized by a low accumulation of dissolved nutrient owing to a high oxygen content, as a result of which there is a little to no plant life. As the phosphorus content of LD slag is high it can be used for the growth of the aquatic floras resulting in the improvement of the aquatic ecosystem.

FIG. 02

Eutrophication also called Hypertrophication is the depletion of oxygen in water bodies which kills aquatic animals. It is a result to the addition of excess nutrients mainly phosphates which induces excessive growth of plant and algae. After the death of such organisms bacterial degradation occurs which consumes oxygen, depleting it from the aquatic body[12]. As phosphorus plays a vital role for the growth of plants and it is a major component of LD Slag it can be used to support the environment in a better way. LD slag can also be used as sand-capping material so that nutrient from the soil can be prevented to flow into the water bodies.

Sadakata, Professor at the University of Tokyo, took an interest in LD slag as a means of supplying iron as a nutrient to curb Oligotrophication of seawater. Here a mixture of artificial humus soil, obtained by fermentation of waste wood chips, and LD slag, subjected to the process of carbonization, was used. The mixture was placed in water-permeable coconut bags (Beverly Unit) and uniquely shaped steel cases (Beverly Box), and the bags and cases were settled at suitable points in the experimental sea area[13].

Harmful effect of slag on environment[14]

Most slag contains impurities of toxic elements, such as As, Pb, Cd, Co, Cr or Ni. Since these substances can be leached to some extent from the slags, possible environmental hazards cannot always be excluded.

The gaseous emissions from the salt slag (slurry) that result from contact with water are of great environmental concern. These elements even though not in a large amount affects environment a lot.

III. RESULTS AND DISCUSSIONS

LD slag or steel slag, a by-product of the steel making process is one of the important waste materials generated in steel plants. The presence of phosphorous in it is quite high which restricts its utilisation in iron and steelmaking directly. The amount of phosphorus can, however, be reduced by physical and chemical means. Besides its effective use as road making, cement producing, fertilizers it can very well replace lime addition to the steelmaking route due to its high lime content and can be used for various purposes including calcium oxide based
reformer (ground improvement or soil improvement), source of iron for sea weed beds.

Because many of the uses represents natural substitutes for man-made materials, expansion of the applications of slag is an activity that greatly contributes to the environmental conservation.

At European level, the legal framework acts under which the road builders should provide 20-30% of the necessary material by industrial waste management, slag being an important part in it[15]. As the step taken is a good one all countries should focus on steps like this.

Eutrophication is a great problem in the mid-20th century the World Resource Institute got coastal zones in the world with high concentration of minerals covering eastern and southern coast of US, East Asia and mainly Japan.

Developed countries such as Japan is working for the utilization of LD slag in a better way to promote the aqueous life and enhance fisheries by increasing mineral content by providing nutrients required for the growth of coral weeds.

Many of the steel companies of the world are not utilizing LD slag properly and prefer to dump it. So they start utilizing LD slag like Japan, China etc then it will act as a great remedy for environmental pollution. By harnessing the deposits we will be able to recover large area for agriculture.

There are so many challenges related with the same such as Health hazard, environment disregard etc. We can use LD slag for creating the favorable condition, essential for environment.

IV. CONCLUSION

LD slag is a major by-product in steelmaking, if not utilized in a proper way or by dumping in an area can cause harmful effects to the environment. But it can be used to help the environment, e.g., soil, aquatic life etc. It can be utilized not only from economic point of view but also from the environmental viewpoint, if utilized by proper processing and channeling. In future it can contribute to our society, mankind to an extended level if proper incentives will be taken in time, for the advancement of the environment.

REFERENCES


AUTHORS

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Relationship between dimensions of HRM (employee training, motivation and Process Control) technology Innovation and firm Performance: Empirical Evidence from Telecommunication and manufacturing industries of Lahore in Pakistan

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Abstract- Purpose: Human resource management (HRM) is seen as crucial for innovation and organization’s performance in Pakistan. This study aims to carry out an empirical research to investigate the effects of main dimensions of HRM on technological innovation as well as firm’s performance.

Methodology: Researcher used seven-point Likert scale in questionnaire. The research uses a sample of 250 high-tech firms surveyed in Pakistan, Lahore. 300 questionnaires were administered out of which 250 questionnaires received back.

Findings: This research finds that employee training, material, immaterial motivation and process control and outcome control have positive effects on technological innovation. It is also found that technological innovation is positively related with performance.

Research limitations: This study does not consider the different influence of every HRM dimension affecting different innovation types. This should be a future research topic. Practical implications: This study provides useful managerial implication for managers. First, Employee training is needed to develop employees’ knowledge. Second process control should be emphasized more than outcome control in high-tech firms.

Significance: This study demonstrated that the HRM significantly contributed to technological innovation and firm performance. This study demonstrates that high-tech firms’ HRM has an important influence on technological innovation, and lead to firm’s superior performance.

Index Terms- Human resource management, Motivation, Innovation, Organizational performance, Pakistan.

I. INTRODUCTION

1.1 Background of the study
The connection amongst HRM and firm execution has become amazing thought from HRM investigators and development masters as of late. A perpetual research has exhibited the positive relationship amidst HRM and a given firm execution(Schuler and Jackson 1987). Look into has moreover been done on the connection between mechanical development and firm execution (Hill and Rothaer 2003); (Tripsas and Gavetti 2000) in any case, a couple crevice(Liu, Xiao et al. 2006) in this exploration field remain. At first, few reviews analyzed the way in which the relative components in human asset administration impact firm Innovation hypothesis holds that firm advancement can help firms seize openings in unverifiable circumstances, secure upper hands over adversaries, and essentially affect firms’ long haul execution (Hitt, Hoskisson et al. 1997). Of course, couple of researchers on advancement can discover correctly where development originates from (Damanpour and Gopalakrishnan 1998).

1.2 Problem Statement
The connection amongst HRM and firm execution has gotten significant consideration from HRM analysts as of late. A few crevices have stayed in researcher field, for example, few reviews have looked into the route in which relative variables of HRM impacts firm execution in mechanical advancement. In history numerous innovative firms have been set up in Pakistan. These organizations must not be disregarded on the grounds that they assume a critical part in monetary and social advancement of the nation. Keeping in mind the end goal to address these noteworthy holes, this review would research connection between HRM rehearses, mechanical advancement and company's execution by utilizing theoretical structure.

1.3 Research Questions
• In what way workers preparing can improve their employee execution by utilizing the innovation development, the country like Pakistan?
• In Pakistan, is there a relationship between Innovation, HRM and extinction that can adequate and usable.
• In HRM is there any role of administrative management and innovation in the sector of organizational of Pakistan.

1.4 Objectives of the study
In an organization HRM is viewed as vital for advancement and firm execution. Innovation technology has turned into a key issue in connection to the solid rivalry between HRM and company's execution. The exploration means to complete an experimental research to examine the impacts of fundamental measurements Employee Training, Immaterial Motivation and Process Control of HRM on innovation technology and additionally authoritative execution.
1.5 Significance of the study
This review exhibited that the Human Resource Management essentially added to innovation technology and organization execution. So it reviews exhibits that cutting edge organizations' Human Resource Management has a vital impact on innovation technology, and prompt company's unrivaled execution. Asset based hypothesis and development speculations have affirmed the significance of both Human Resource Management and innovation technology on a company's execution. This review, our commitments concentrate on the working of a reasonable system that illuminates the connection between Human Resource Management, innovation technology and firm execution, and we look at the impacts of cutting edge Company’s Human Resource Management on innovative technology and firm execution. Laying-out on asset based hypothesis and development hypothesis, this review exhibits that a cutting edge company's Human Resource Management has an imperative impact on innovative technology, which prompts that association's unrivaled execution. Past giving a rich depiction of the connection between Human Resource Management, innovation technology and execution.

II. LITERATURE REVIEW

2.1 Human Resource Management
HRM characterize as a business' key destinations is to augment worker execution in administration which is capacity of Human Resource Management (Damanpour and Gopalakrishnan 1998). HR is basically connected with the organization of people inside the association, focusing on plans and on structures (Collings, Scullion et al. 2009). Human Resource offices and units in associations conventionally endeavor different activities, including agent favorable circumstances arrange, specialist enlistment, "preparing and advancement", execution examination, and fulfilling e.g., overseeing pay and advantage systems (Paauwe and Boon 2009).

2.2 Training
Preparatory is an arranged exertion by an organization to encourage learning of occupation related abilities, information, aptitudes and practices by representative (Aubert, Barate et al. 2006). It includes procedure of changing representative conduct and states of mind to build the likelihood of objective achievement (Aubert, Barate et al. 2006). The worker can all the more quickly secure new information and further capabilities by training and create advancement (Aubert, Barate et al. 2006).

2.3 Motivation
The word motivation is the implementation or arrangement of presenting an objective that beginning stage of a person to achieve some achievement (Aubert, Barate et al. 2006). The concept of motivation has gotten from "motive", means a reason of acting, impulse or effect to proceed for fulfilling the need (Kamalian, Yaghoubi et al. 2010). The inspiration which is also known as motivation of the delegate has coordinate effect onontological advancement, through there are ,as it is not ignoring, various outcomes from particular researchers (Kamalian, Yaghoubi et al. 2010)(Baer, Oldham et al. 2003)

The central power through which individuals distribute push to make and perform innovative contemplations is motivation(Liu, Cao et al. 2006). Then again, working employees are quite recently convinced to go past their allocate out part and get incorporated into unconstrained and inventive activities if they have a strong recognizing evidence with the affiliation. Various leveled society expect an essential part in rousing creative direct, as it can make obligation among people from a relationship to the extent confiding being developed as a legitimate regard and enduring progression related benchmarks dominating within the association (Dulaimi and Hartmann 2006)

2.4 Innovational technology
By the performance that innovation technology is a method run with high peril, it is essential to use fruitful controls to diminishing possibility and redesign capability. There are two types of important inward controls associated with an affiliation's mechanical improvement: result control and get ready control .Outcome control focuses on last performance and includes action criteria, for instance, level of benefit to appraise (Hitt, Hoskisson et al. 1996). Handle control includes subjective and on occasion instinctual criteria for appraisal and highlights the whole deal performance of organization (Bahl, Ritzman et al. 1987).

2.5 Training of employee and innovation technology
The training is consider an arranged exertion by an organization to encourage learning of occupation related capabilities, information, aptitudes and practices by worker (Kolisich and Hartmann 2006). It includes procedure of changing representative conduct and states of mind to build the likelihood of objective fulfillment (Antwi, Analoui et al. 2007). The worker can all the more quickly secure new learning and further create development and skills through training (Chi, Bassok et al. 1989)and(Sabella and Analoui 2015).

2.6 Motivation of employee and innovation technology
The motivation is an execution or methodology of displaying an aim that inception a man to catch some accomplishment (Messias, Castro et al. 2011). Motivation has gotten from "propel", intends to move, push or impact to continue for satisfying a need (Kamalian, Yaghoubi et al. 2010).Motivation of the worker has coordinate impact on mechanical advancement, through there are ,as it is unavoidable, diverse outcomes from various researchers (Amabile, Hennessey et al. 1986),(Baer, Oldham et al. 2003).

2.7 Control and innovation technology
Everlasting noteworthy way to deal with work headway is to fulfill various leveled viability through innovation development and performance based key HRM intercessions (Osman-Gani and Zidan 2001); (Aggarwal, Han et al. 2003). The snappy authoritative re-sorting out and comprehensively disseminated building have required the prerequisites for composed systems and the better methodologies for Human Resource Management in propelling innovation technology, various leveled change and business (Chung 2002) Numerous masters in this way focused their work on the key issues of incorporated technological innovation -HRM procedures and predominant development work (Wang and Wang 2005).

2.8 Control and Motivation
The inspiration which is also known as motivation of the specialists has coordinate effect on innovation technology, through there are, as it is inevitable, unmistakable outcomes from different analysts (Amabile 1988),(Eisenberger, Armeli et al. 1998). The concept of motivation is the essential power through which individuals relegated push to deliver and complete innovative considerations. Then again, representatives are quite recently spurred that they go into past doled out part and get included in intentional and imaginative exercises in the event that they have a strong conspicuous confirmation with the firm. Hierarchical culture assumes a crucial part in propelling inventive conduct, so it is the duty among people from an association or outside the association by means of email, web, fax or past reports and overviews. An opportunity to get to the outer sources and looking at the physical draw, for example, the change of publicizing technique, thing upgrades and the headway of administration strategy means and methodologies; while there are movements offer conditions, resources and probabilities of results for high advantages and it improve the execution of big business. Wares advancement can make endeavors construct the open entryways for improvement and expansion; innovative conduct and activities will pass on the fundamentals of contentions to the affiliation. Albeit speculatively most scientists trust that development must have a section on improving the firm execution, there is every so often exact support in certifiable research.

3. Methodology
3.1 Method for data collection

The sort and amount of information to be gathered relies on the way of the review together with its exploration objective. There are distinctive information gathering strategies that are being utilized as a part of the examination, understanding. The part of specialist set the phase for discourse of issues required in gathering information (Trotter 2012). Analyst chooses the appropriate information gathering strategy as per study impediment. These are depicting howl (Hair, Wolfinbarger et al.) also (Samouel, Money et al. 2003), Essentials of Business Research Methods, John Wiley and Sons Inc., New York. Corsten, D. also, (Kumar and Phrommathed 2005) "Do Suppliers Benefit from Collaborative Relationships with Large Retailers? An Empirical Investigation of Efficient Consumer Response Adoption",(Balmer, van Riel et al. 1997).

3.2 Primary
Essential source gives the direct data to researcher. The numerous systems which be utilized to gather the essential information. The selection of procedures relies on the reason for the review (Kumar and Phrommathed 2005). Overviews on telephones, PC exchange, mail catches, and fax study and up close and personal meetings are the essential information accumulation strategy. Taking after is the rundown of sorts of Primary information gathering strategy.
1. Different people interviews
2. Filled questionnaires
3. Observing respondents

3.3 Secondary
The second technique for the collection of data comprises on organization records, assessing concentrates distributed by outer sources and looking at the physical draw, for example, elimination and growth (Albaum and Smith 2005). The data which is based on secondary as of now exist inside the association or outside the association by means of email, web, fax or past reports and overviews. An opportunity to get to the data which is secondary is generally short and may not be issue particular (Wegner 2010). Taking after is the rundown of sorts of Secondary information accumulation strategy: (Treiblmaier and Filzmoser 2011), Fundamentals of advertising examination, Sage Publication, London, Applied Business Statistics Typesetter, Lebanon Publishing Service, USA.

3.4 Research Model
As this review is examining the connection Between features of HRM (Training of Employee , Motivation which is Immaterial and Control in Process ), Innovation Technology and Performance therefor, incentive material demonstrates that worker preparing, material impetuses, result evaluation and control, non-material motivators, handle examination and control are variables which are independent, the mediating variable is innovation technology and variable which is dependent is performance.
3.5 Research Design

Most imperative piece of this section is to build up the design of the research due to which every last basic part of research is produced such that is most suitable to issue under thought. The research configuration make less demanding for the specialist to execute the analyst procedure while it additionally serves in research of minimization endeavors as it evacuates ambiguities in setting of research sort, test choice, information gathering and the process of analysis.

3.6 Nature of the study

Essentially of that review is of four unique structures exploratory, co-relation, study which is casual due to environment and descriptive. Current reviews are in nature explanatory and descriptive with respect to achievement of the objectives.

3.7 Type of investigation

In research, various types of examination like case study, method of survey and experimental, and observational. These all are altogether led in fundamentally two sorts of settings first is thought up setting and second is non-created setting. At the point when information is gathered through most extreme obstruction at work put it will be viewed as research has done in devised .On the other hand examine finished with negligible impedance at work environment will be viewed as non-thought up setting. In current review data was gathered through overview technique which is method of survey.

3.8 Time Horizon

By utilizing the method of survey data can gathered in two courses either at one purpose of time that is viewed as a study of cross sectional or gathering the data some other way than one purpose of time that is viewed as study which is longitudinal. Now this study is longitudinal.

3.9 Instruments

For the collection of data questionnaire technique is used of 30 questions are utilized. From these 30 questions 5 of them are based on the respondents demographics of respondents, 25 questions are significant to 7 factors being researched to study. All inquiries incorporated into the survey are created to 5 options based on scale which are Likert and with the help of study based on various topics questionnaire is taken (Deelman, Callaghan et al. 2006).

IV. ANALYSIS AND RESULTS

This section introduces the data analysis. The main part talks about the respondent's statistic profiles and show the summery based on descriptive including standard deviations and mean for variables. Second part clarifies the evaluated aftereffects of validity and reliability of estimations of builds. The third part displays the consequences of analysis which is regression. Hypothesis relationship is explained in the conceptual model which examines the hypothesis test in an order.

4.1 Descriptive statistics

4.1.1 Respondents demographic profile

The questionnaires were distributed to various industries such as engineering, telecom and manufacturing. Total numbers of questionnaires were 305 out of which 250 were received back.
with 82% of appropriate response Table 1. Shows the respondents profile of demographic. The table consists on information of all respondents such as age, gender, how many employees and in which sector they are working.

Table 1 Respondents profile of demographic

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender (N = 250)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>196</td>
<td>76</td>
</tr>
<tr>
<td>Female</td>
<td>52</td>
<td>21</td>
</tr>
<tr>
<td><strong>Age (N = 250)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–29</td>
<td>86</td>
<td>35</td>
</tr>
<tr>
<td>30–39</td>
<td>117</td>
<td>47</td>
</tr>
<tr>
<td>40–49</td>
<td>35</td>
<td>14</td>
</tr>
<tr>
<td>50–59</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td><strong>Employees</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 or less</td>
<td>64</td>
<td>25</td>
</tr>
<tr>
<td>51–200</td>
<td>52</td>
<td>21</td>
</tr>
<tr>
<td>201–500</td>
<td>63</td>
<td>25</td>
</tr>
<tr>
<td>1000 or more</td>
<td>71</td>
<td>28</td>
</tr>
<tr>
<td><strong>Sector</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telecommunication</td>
<td>65</td>
<td>26</td>
</tr>
<tr>
<td>Engineering</td>
<td>58</td>
<td>23</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>127</td>
<td>50</td>
</tr>
</tbody>
</table>

1st table demonstrates that received back questionnaires were 250 which are based on 196 males and 52 females, while 2 respondents did not give any data with respect to their sexual orientation. According to age there were 86 respondents within the age of 20 to 29. From the age of 30 to 39 the numbers of respondents were 117. From the age of 40 to 49 the numbers of respondents were 35. From the age of 50 to 59 the numbers of respondents were 12. Most of the respondents are less than the age of 50; this demonstrates a large portion of respondents in this review are below than 50. Respondents from the total of 305, 250 provided the information that head of number of employees based of 64 industries are working with fewer than 50 employees, 52 ventures are locked in with 51-200 number of employees and 71 enterprises are more than 1000 workers. From the response of 250, 65 are working with the sector of telecom, 58 are working with the sector of engineering and 127 are working with the sector of manufacturing.

4.2 Analysis and results
4.2.1 Reliability test

The second table shows the evaluated estimations of Cronbach's coefficient alpha that analyze for measurement of the internal consistency ans reliability. For the current specimen, estimations of Cronbach's alpha change from 0.874 to 0.898 which shows the every multi-thing develop have high possess reliability: the training of employee (alpha = 0.898), incentive material (alpha = 0.881), incentive non-material (alpha = 0.894), control on process(alpha = 0.881), control on outcome(alpha = 0.874), innovation technology (alpha = 0.876) and performance of firm (alpha = 0.877) have high possess reliability. The high Cronbach's alpha incentive for each build suggests that they are inside reliable. Facilitate, things of each develop measure a similar substance all around. In a nutshell, the higher the Cronbach's estimation of a develop, the higher the reliability is of measuring a similar build.

Table 2 Measurement of reliability

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Valid N</th>
<th>Number of Items</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>The training of employee</td>
<td>250</td>
<td>3</td>
<td>0.898</td>
</tr>
<tr>
<td>Incentives Material</td>
<td>250</td>
<td>3</td>
<td>0.881</td>
</tr>
<tr>
<td>Incentives Non material</td>
<td>250</td>
<td>3</td>
<td>0.894</td>
</tr>
<tr>
<td>Control on Process</td>
<td>250</td>
<td>3</td>
<td>0.881</td>
</tr>
<tr>
<td>Control on Outcome</td>
<td>250</td>
<td>3</td>
<td>0.874</td>
</tr>
<tr>
<td>Innovation Technology</td>
<td>250</td>
<td>5</td>
<td>0.876</td>
</tr>
<tr>
<td>Performance of Firm</td>
<td>250</td>
<td>4</td>
<td>0.877</td>
</tr>
</tbody>
</table>

4.2.2 Regressing analysis

The analysis of regression has been utilized to decide the impact of variable which is independent (i.e. training of employee, incentive material, incentive non-material, control on process and control on outcome) on variable which is mediating i.e. innovation technology and to decide the mediating factor on variable which is dependent (performance of firm) then incentive material impact on control in outcomes and incentive non-material impact on control on process. As appeared in Figure below 2. Now by the help of results we can demonstrate a there is a positive significant outcome of training employees on innovation technology (β = 0.495, P<0.001), incentive material on innovation technology (β = 0.556, P<0.001), incentive non-material impetus on innovation technology (β = 0.504, P<0.001) and control process on innovation technology (β = 0.663, P<0.001) and control outcome on innovation technology (β= 0.664, p<0.001). Incentive Material and control outcome ((β = 0.688, P<0.001) and incentive non-material and control process (β = 0.504, P<0.001). This demonstrates that innovation technology catches the most extreme impact of control outcome and innovation technology catches minimal impact of training employee.

Likewise, the variable which is mediating has a positive huge impact on performance of firm: innovation technology on performance of firm (β = 0.711, p <0.001). Comes about unmistakably represent that innovation technology greatly influence performance of firm.
4.2.3 Mediating analysis

In this analysis that the immediate impacts of an independent factor on a mediating factor, of a mediating factor on a dependent factor and of an independent factor on dependent factor are considered significant then the mediation might be tried. For the test of a mediating variable, independent factor and mediating factor both are gone into a regression for same purpose from independent factors. On the off chance that coefficients of both factors (i.e. mediation and independent) are noteworthy then it demonstrates the incomplete mediation of intervening variable between dependent factor and independent variable. In some cases that coefficient of the intervening variable stays noteworthy yet the coefficient of independent factor turns irrelevant when both are entered in a regression for same purpose from independent factors, then it indicates full intercession of intervening variable between dependent factor and independent variable. In utilized analysis of regression of employee to decide the centrality of intervention of mediating factors between independent factor and dependent factors.

Figure 2 shows to that there are significant immediate impacts of dependent factors on mediating factor and of intervening variable on dependent factor. Table 3 shows to those immediate impacts of independent factors on dependent factors are critical. So the mediation conditions for testing are fulfilled.

**Table 3 Direct effects of HR policies on performance**

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Performance of Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training of Employee</td>
<td>.532*</td>
</tr>
<tr>
<td>Incentives Material</td>
<td>.584*</td>
</tr>
<tr>
<td>Incentives Non-material</td>
<td>.472*</td>
</tr>
<tr>
<td>Control on Process</td>
<td>.613*</td>
</tr>
<tr>
<td>Control on Outcome</td>
<td>.658*</td>
</tr>
</tbody>
</table>

“Note: * represents significance at less than 0.01”

Table 3 demonstrates that training of employee, incentive material, incentive non-material, control on process and control on outcome adds to performance of firm are significantly positive. The results demonstrate that innovation technology comparatively mediates between independent factors (i.e. training of employee, incentive material, incentive non-material, control process and control outcome) and dependent factors. Training employee on performance of firm ($\beta = 0.238$, $p < 0.001$), incentive material on performance of firm ($\beta = 0.584$, $p < 0.001$), incentive non-material on performance of employee ($\beta = 0.151$, $p < 0.001$), control process on performance of firm ($\beta = 0.253$, $p < 0.001$) and control outcome on performance of firm ($\beta = 0.332$, $p < 0.001$).
appropriately, worker preparing helps cutting edge firms to not only overhauling their headway limit through data trade and aptitude change.

Our discoveries exhibit that motivational material are specifically identified with innovation technology and that incentive non-material forces are likewise emphatically identified with innovation technology in cutting edge firms. These discoveries bolster the contention of Amabile and her colleagues (Amabile 1988).

Interim, the last finding is likewise predictable with past research comes about that found that stipend of self-development and autonomy in the working environment can improve the innovation technology work of the employees in cutting edge firms (Li, Zhao et al. 2006);(Mumford 2000). The consequences of this review emphatically propose that procedure evaluation and control is decisively identified with innovation technology, while result examination and control is likewise specifically identified with innovation technology. Our discoveries fortify the work by (DeTienne and Koberg 2002) and analyze the exploration of (Spender and Kessler 1995), both of whom noticed that procedure control is useful to development. Then again, prepare examination and control is of advantage in empowering hazard taking activities of workers. In this manner, our exploration comes about approve the perspective of (Mumford 2000), and furthermore bolster the examination of (Hitt, Hoskisson et al. 1996) and also(Scott 1994). This review looks at the point of view that there is a cozy connection amongst inspiration and control (Bradley and Gelb 1981);(Orpen 1994). Inquire about outcomes propose that incentive material force is emphatically identified with result control, and incentive non-material is decisively identified with process control. These discoveries propose that cutting edge firms require successful outcomes estimation and evaluation when they underscore incentive material forces.

When underscoring incentive non-material, it is essential to utilize prepare examination and control. These discoveries demonstrate that cutting edge firms ought to pick successful control strategies in light of the workers' requests and the necessities of innovative firms to rouse the employees. In concurrence with many research comes about (Abernathy and Utterback 1978);(Hill and Rotheram 2003);(Tripsas and Gavetti 2000), we additionally affirm that innovation technology is emphatically identified with firm execution amid the Pakistani financial transitional period. The innovation technology of cutting edge firms has a vital impact on firm execution, and successful Human Resource Management can guarantee manageable innovation technology in innovative firms. Thus, viable Human Resource Management can upgrade the execution of cutting edge firms by expanding innovation technology.

## DISCUSSION AND CONCLUSION

### 5.1 Findings in the study

Based on hypothesis and innovation theories have confirmed significance of both Human Resource Method and mechanical advancement on an association's execution. In this review, our commitment focus on the working of an applied system that clears up that connection between Human Resource Management, innovation technology and firm execution, and we inspect the impacts of cutting edge association's Human Resource Management on innovation technology and firm execution in Pakistan. Drawing on asset based hypothesis and advancement hypothesis, this review demonstrates that a cutting edge association's Human Resource Management vitally affects innovation technology, which prompts that association's prevalent execution. Past giving a rich portrayal of connection between Human Resource Management, innovation technology and firm execution. This review demonstrates a couple of critical discoveries. Right off the bat, we find there is sure immediate effect on innovation technology by worker preparing in cutting edge firms. This result gives the support for asset based hypothesis that always overhauling the way of an association's HR will expands the association's upper hand.

Right when a firm needs to get an upper hand in a dubious financial condition, for instance, Pakistan, there is a necessity for higher quality HR, which can be gained via preparing all workers of the firm. For cutting edge firms in the nations with a creating economy for instance, Pakistan, there are various market openings due to monetary moves and institutional changes. Appropriately, worker preparing helps cutting edge firms to not simply increment inventive progression through extended adapting, furthermore to discover new market openings and to

### Table 4 Hypotheses results summary

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: There is a positive relationship between training of employee and innovation technology</td>
<td>Supported</td>
</tr>
<tr>
<td>H2: There is a positive relationship between incentives non material and innovation technology</td>
<td>Supported</td>
</tr>
<tr>
<td>H3: There is a positive relationship between non material and technology innovation</td>
<td>Supported</td>
</tr>
<tr>
<td>H4: There is a positive relationship between appraisal and control based on innovation outcome and technology innovation</td>
<td>Supported</td>
</tr>
<tr>
<td>H5: There is a positive relationship between appraisal and control based on innovation process and technology innovation</td>
<td>Supported</td>
</tr>
<tr>
<td>H6: There is a positive relationship between material incentives and outcome control.</td>
<td>Supported</td>
</tr>
<tr>
<td>H7: There is a positive relationship between nonmaterial incentives and process control.</td>
<td>Supported</td>
</tr>
<tr>
<td>H8: There is a positive relationship between technology innovation and firm performance</td>
<td>Supported</td>
</tr>
</tbody>
</table>

## REFERENCES


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Image compression and enhancement by using the LZW and BHEPL

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**Assistant Professor, Department of CSE, SRSM University, Lucknow

Abstract- This paper describes the lossless data compression techniques LZW and also discusses about its enhancement. In lossless data compression there is no loss in original information, means that the pre-compressed and decompressed information is same. The BHEPL is used to short processing time for image enhancement. Bi-Histogram Equalization with a Plateau Value (BHEPL) is similar to Brightness Preserving Bi-Histogram Equalization (BBHE). BHEPL enhancement method is the combination of two methods first one is BBHE and second one is clipped histogram. In BBHE we first calculate the average intensity of input image. And in BHEPL enhancement method we divide the input image into two parts or two sub images and then decide the plateau value of each sub part of the image. This paper discus about LZW, BHEPL, original enhancement image and compressed enhancement image.

Index Terms- LZW compression, Histogram equalization, clipped histogram equalization, Bi-histogram equalization with a plateau value (BHEPL).

I. INTRODUCTION

(A) LZW data compression

LZW is the lossless data compression method which is used for minimizing the numbers of bits in original information. LZW was proposed in 1984 by `Welch`. Its output contains pointers that indicates a previously parsed substring, and these are of fixed size. It is dictionary based method. It's introduced by Lempel-Ziv. First method introduced in dictionary based is LZ77 and then second one is LZ78, some improvement was done in LZ78 by `Welch' and named it LZW. In this paper LZW compression and decompression algorithm is applied on gray level image. this method, one by one read the gray level pixel of input image and check in dictionary or table the input pixel is present or not. Pixels are present, then provide the location of same pixel as a output or same code provide as a output of previous same pixel.

LZW compression Algorithm
Start
lastcode=NULL
LOOP
read the input image c
if ((lastcode, c) in the dictionary)
    lastcode=location of (lastcode, c)
else
    output=lastcode
add the lastcode and c in the dictionary
lastcode=c
End

LZW decompression Algorithm
Start
Read the output of compression (c)
lastcode=c
LOOP
    Read the input length::J<-2:length(input)
    element=dictionary entry for c
    add(lastcode,c) in dictionary
    lastcode=element
END

(B) Histogram equalization

Histogram equalization is used to contrast enhancement of image. Enhancement is the important area of image processing. It is used for human and computer vision. Contrast enhancement is also used in medical area, speech recognition and also used in many applications of image and video processing. There are many methods developed for image enhancement. Some of these methods make use of simple linear/nonlinear gray level transformation functions [1] while some of the others use complex analysis of different image features such as edge [2], connected component information [3].

Histogram equalization is used for enhancement in any type of image but it is not compulsory, it always increase the contrast enhancement. In many cases contrast enhancement will be decreased by using histogram equalization.

There are two important concepts used in histogram equalization:
- PMF (Probability mass function)
- CMF (cumulative mass function)
Image histogram is used for graphical representation of the gray values in digital image. By using the image histogram, that can analyze the frequency of appearance of the different gray levels of an image.

(c) Clipped histogram equalization

Clipped histogram equalization methods are able to control the enhancement rate [4]. The enhancement rate is proportional to the rate of cumulative density function. We want to control the enhancement rate, so limiting or controlling the value of probability density function. clipped histogram equalization modifies the shape of the input histogram by reducing or increasing the value in the histogram’s bins based on a threshold.
limit before the equalization is taking place [4]. Threshold value also called the plateau value.

(D) Bi-histogram equalization with a plateau value (BHEPL)
In this method first of all divide the input pixel into two subgroups. Histogram created by these two subgroups and find plateau value of these two sections of input. It is the best method for contrast enhancement compare to BBHE. This HE method is the combination of two methods, these two method are clipped HE and BBHE.

II. OVERVIEW OF THE RESEARCH

[A] Manpreet Kaur et al [5] Image enhancement is the very important part of image processing. Process involves in this enhancement technique, the intensity of pixels' changes in original image. The purpose of image enhancement is to improve the interpretability or perception of information contained in the image for human viewers, or to provide a “better” input for other automated image processing systems [5]. This paper shows the different types of Histogram Equalization on the bases of higher brightness preservation and the quality of output image. In this paper different types of HE are discuss like BBHE, DSIHE, RMSHE, MMBEBHE etc.

[B] Taekyung Kim et al [6] the paper proposes the adaptive contrast enhancement algorithm that is gain controllable clipped Histogram equalization (GC-CHE). It uses the clipped histogram to preserve the brightness of the original image. And also proved this proposed method on various types of input images. Compare to other HE based method, GC-CHE is the simple, regular computation structure, and also implemented in real time or embedded system.

[C] Seungjoon Yang et al [7] paper discusses about the mechanism to control the rate of enhancement. The HE is used in image processing for enhancement method. The gradient of the mapping function is controlled by putting constraints on the probability density function with the bin underflow (BU) and bin overflow (BO) [7]. The BUBO method used for enhancement rate in whole HE with the use of only one parameter. Put the constraints on pdf of input image, the minimum and maximum gradients function used for enhancement rate, and also provide the black and white level automatic brightness control.

[D] Smitha Rao et al [8] in this paper discusses the various types of lossless technique in data compression. And also discuss the various challenges in compression of various types of data in many applications.

In paper, discuss the dictionary based method and statistical method for text compression. And in the dictionary based method discuss the LZW as compare LZ77 and LZ78. The arithmetic algorithm provides the better result as compare then the Huffman and RUN algorithm in the statistical method. And also discuss the DWT etc.

[E] Gaurav Gupta et al [9] in this paper discuss the image compression using lossless data compression. In this lossless data compression used in image compression there are no loss in the original image. And also discuss in paper three factors about compression there are quality of image, amount of compression bits, and speed of compression.

III. METHODOLOGY

In this paper the methods for combination of data compression and enhancement of image is proposed. LZW lossless technique is used for compression of pixels and BHEPL method of HE used for enhancement of an image. The original image change into the gray level and also change in unit 8 and pass the LZW algorithm this algorithm is based on dictionary based and finally apply BHEPL for enhancement to the output of LZW decompression. The BHEPL is the combination of two HE method 1st is clipped HE and 2nd is BBHE.

IV. EXPERIMENTAL RESULTS

This paper discusses about the enhancement before lzw compression and after lzw compression. The BHEPLE is used for enhancement because it is used the short processing time for enhancement. And compression technique lzw is the lossless compression technique. The output of this technique, number of bits is minimizing in original image.

There are three sample images for results of compression and enhancement. First image is Lenna.png, second image is of bird2.bmp and third image is of panda.jpeg. And these three sample images are used in gray level image.

Evaluate the enhancement to maintain the brightness, and measure the performance by using Average Absolute Mean Brightness Error (AAMBE).

Define…. [4]

\[
AAMBE = \frac{1}{S} \sum_{n=1}^{S} |\hat{X} - \hat{Y}|
\]

Where S = total number of sample image
\[
\hat{X} = \text{average intensity of test image n}
\]
Average intensity of the corresponding Output image.

**Absolute Mean Brightness Error (AMBE)**

\[ AMBE = |A(x) - A(y)| \]

Where \( A(x) \) = average intensity of input image.

\( A(y) \) = average intensity of enhanced image.

Table 1 shows the Enhancement before Compression Table 2 shows the Enhancement after Compression and Table 3 shows the LZW Compression. All these three Tables show the performance measure and compress bits in original image. Compress bits shows the minimizing the pixels of an original image pixels.

AMBE is used for measurement of performance of image.
V. CONCLUSION

This paper discusses about the LZW compression and BHEPL method for enhancement. Apply the BHEPL on the output of LZW decompression. This paper also discusses the enhancement method without compression and with compression on three sample input image on the bases of performance. Absolute Mean Brightness Error (AMBE) is used to measure the performance of enhancement on the input images. And also discuss the compression bits of these three input images.

REFERENCES


AUTHORS

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Estimation of Radiological Hazard Indices Due To Radioactivity in Soils in Ibiono Ibom, Akwa Ibom State, Nigeria


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Abstract- The radiological hazard indices due to the radioactivity in soil samples in Ibiono Ibom Local Government Area of Akwa Ibom State, Nigeria were estimated. Soil samples were randomly collected at the depth of 30 cm in different locations from each of the three studied sites. The radionuclide activity concentrations in the soil samples were measured using gamma spectroscopy method. The mean activity concentration of $^{40}$K are $238.10 \pm 22.47$ Bq/Kg, $73.84 \pm 7.15$ Bq/Kg and $106.58 \pm 8.63$ Bq/Kg respectively for the three sites, then for $^{238}$U the mean values for the three sites are respectively $8.26 \pm 2.06$ Bq/Kg, $6.11 \pm 1.58$ Bq/Kg and $3.16 \pm 0.80$ Bq/Kg and for $^{232}$Th the mean values are $9.13 \pm 1.03$Bq/Kg, $8.13 \pm 0.91$Bq/Kg and $5.91 \pm 0.66$Bq/Kg respectively. The mean radium equivalent for the three areas is $27.222$ Bq/kg. The mean absorbed dose rates for the areas were $19.805$ nGy h$^{-1}$, $10.863$ nGy h$^{-1}$ and $9.787$ nGy h$^{-1}$ respectively. The values for all the hazards indices obtained were found to be below the world limits. The level of exposure at the study areas presently poses no significant health threat, hence, the soils can be used as building material.

Index Terms- Activity concentrations, radionuclides, radiological hazard indices, gamma spectroscopy.

I. INTRODUCTION

Soils are natural sources of radioactive materials (NORMs) which are known to be the most prominent means of exposing the public to radiation. Rocks, soils and vegetation are known to contain long half live radionuclides such as Uranium - 238, Thorium-232 and Potassium-40 and the knowledge of these radionuclides distribution in an environment is necessary for the estimation of the effect of radiation exposure due to both terrestrial and extraterrestrial sources (Thabayneh and Jazzar, 2012). It is reported that these NORMs are widely distributed in the rocks, with Potassium as the major element widely present (Gbenu et al., 2016). Environmental problems, such as health threats, associated with these NORMs occur in the process of quarrying, leaching, handling, storage, transportation of quarried products and the use of contaminated equipments without controls. In the process of preparation of these rocks for utilization, these radiations are absorbed by man through food intake and air inhalation. (Innocent et al., 2013).

Recently there is increasing demands for quarry products such as rocks, gravels, clays, stone sands, by state governments, non-governmental organizations (NGOs) and individuals as building materials and for other developmental purposes in this area under study. Therefore, due to the economic values and high demands for the quarry products, some areas of Ibiono Ibom Local Government Area of Akwa Ibom, Nigeria, which are naturally endowed with these resources in a large quantity, are now witnessing commercial quarries. The quarry activities which involve the digging of the ground soils to certain depth in order to bring the natural resources to the top surfaces also bring the NORMs to the soil surface, thereby increasing the radiation exposure to the workers and environment. Therefore the knowledge of the activity concentration of these NORM and their progenies in these soils samples enable one to assess any possible radiological hazards to occupants of the dwellings where these samples are used as building materials to construct homes. Again, the information could be used to estimate population exposure to these radiation both indoors and outdoors as the populace spends 80% of their times indoors and 20% outdoors (Bede et al., 2015). However, no adequate evaluation of the radiological effects due to the radioactivity in the soil in the area has been conducted before now. It is on this background that this work was carried out to assess the level of radiological effects due to the soils in Ibiono Ibom Local Government area.

II. MATERIALS AND METHOD

Ibiono Ibom local government area is situated in the South south geopolitical zone of Nigeria and it lies between longitudes $7^0 38^1$ and $8^0 10^1$ E and latitudes $5^0 51^1$ and $5^0 30^1$ N. It has a large land mass and is highly populated. The area is bounded by rivers from Cross River State also in the south southern part of Nigeria. The villages where soil samples were collected are Ikot Ekwuo Idoro, Ikot Eko and Use Ikot Amama. The major economic activities of the people are predominantly quarrying, fishing and farming. Ibiono Ibom local government area is also highly rich in igneous, sedimentary and metamorphic rocks widely used as building materials in construction of dwelling places and construction of roads

A total of 30 soil samples were randomly collected from the selected abandoned quarry sites in different villages that made up the study area. Fourteen (14) soil samples were collected from Ikot Ekwuo Idoro abandoned quarry sites, eight (8) samples from Ikot Eko village and seven (7) samples from Use Ikot Amama abandoned quarry sites. At each sampling location, the soil surface was cleared of stones, pebbles, vegetation and roots then the rocks samples collected according to (Chad and Ohwekevwo, 2012). It is reported that these NORMs are widely distributed in the rocks samples collected according to (Chad and Ohwekevwo, 2012).

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2012) were sealed in a well labeled polythene bags and taken to National Institute of Radiation Protection and Research (NIRPR), Nigerian Nuclear Regulatory agency (NNRA), University of Ibadan, Nigeria for analysis.

The collected soil samples were first dried and then crushed, grounded and passed through a sieve of 1.0mm mesh size. The fine-grained powder of each sample obtained were dried in an oven to about 110⁰C for 2 hours to ensure total removal of moisture and 300g of each dried prepared sample was sealed in a cylindrical plastic container and properly labeled for easy identification. The prepared samples were stored for a period of 30 days to ensure secular radioactivity equilibrium between 226Ra and its short lived progeny (EL-Arabic, 2005). In the laboratory, the activity concentrations of uranium–238, thorium–232 and potassium–40 were determined using gamma spectrometer coupled to NaI(TI) detector. The data acquisition and analysis of gamma spectra were made possible by a computer base multi-channel analyzer program and the radionuclide activity concentration per unit mass (c) was calculated using equation (1) (Essien and Akpan 2016)

\[
c = \frac{N}{\xi \gamma M}
\]

Where M is the mass of the samples measured in Kg, \( \xi \) the detector energy dependent efficiency, t is the counting live time (s), \( \gamma \) is the gamma ray yield per disintegration of the nuclides and N is the net peak area of the nuclide.

111 Radiological hazard indices

The radiological hazard indices considered for this work are radium equivalent activity, radioactivity level index, absorbed dose rate, annual effective dose equivalent, external and internal hazard indices as well as the excess lifetime cancer risk.

Radium Equivalent Activity

The radium equivalent activity, \( R_{aeq} \) is used to compare the specific activities of material containing different quantities of \( ^{238}U \), \( ^{232}Th \) and \( ^{40}K \). The values of \( R_{aeq} \) could be obtained from (Bede et al., 2015)

\[
R_{aeq} (BqKg^{-1}) = C_u + 1.43C_{Th} + 0.077C_K
\]

where \( C_u \), \( C_{Th} \) and \( C_K \) are the average activity concentrations of \( ^{238}U \), \( ^{232}Th \) and \( ^{40}K \) respectively. In calculating \( R_{aeq} \) values, the average activity concentration of 370Bq/kg, 259Bq/kg and 4810Bq/kg used for \( ^{238}U \), \( ^{232}Th \) and \( ^{40}K \) radionuclide, respectively, were assumed to produce the same gamma dose rate (EL-Taher et al, 2004).

Absorbed Dose Rate in Air

The effects of gamma radiation, emanating from radioactive sources in the environment, are usually given in terms of the total gamma radiation absorbed dose rate in air, \( D_y \) and is calculated from the measured activity concentrations of \( ^{238}U \), \( ^{232}Th \) and \( ^{40}K \) radionuclides as

\[
D_y (nGyh^{-1}) = 0.427C_u + 0.662C_{Th} + 0.043C_K
\]

Annual Effective Dose Equivalent

The annual effective dose equivalent (AEDE) received by individuals are generally obtained from the calculated values of \( D_y \) by applying the conversion factor of 0.7SvGy⁻¹ and the occupancy factors of 0.2 and 0.8 for outdoors and indoors effective doses, respectively (UNSCEAR, 2000). The annual effective dose outdoor (AEDE outdoor ), the annual effective dose indoor, (AEDE indoor) and the total annual effective dose (AEDE total), are obtained using the following relations.

\[
AEDE_{outdoor}(mSvyr^{-1}) = D_y(nGyh^{-1}) \times 24h \times 365.25days \times 0.2 \times 0.7SvGy^{-1} \times 10^{-6}
\]

\[
AEDE_{indoor}(mSvyr^{-1}) = D_y(nGyh^{-1}) \times 24h \times 365.25days \times 0.8 \times 0.7SvGy^{-1} \times 10^{-6}
\]

where \( M_t \) is the mass of the samples measured in Kg, \( \xi \) the detector energy dependent efficiency, \( \gamma \) is the gamma ray yield per disintegration of the nuclides and \( N \) is the net peak area of the nuclide.

The total annual effective dose equivalent could be obtained from (Gbenu et al 2015)

\[
AEDE_{total}(mSvyr^{-1}) = 5AEDE_{outdoor}
\]

External and internal hazards indices

The external radiation hazard index, \( H_{ext} \) corresponding to \( ^{238}U \), \( ^{232}Th \) and \( ^{40}K \) natural radionuclides are calculated using the relation below

\[
H_{ext} = \frac{C_K}{4810} + \frac{C_{Th}}{259} + \frac{C_U}{370}
\]

where \( C_u \), \( C_{Th} \) and \( C_K \) are the activity concentrations of \( ^{238}U \), \( ^{232}Th \) and \( ^{40}K \) respectively. In calculating radium conversion factors (Bede et al 2015). In comparison to equation 6, we can have equation 9.

\[
H_{total} = H_{ext} + H_{in}
\]

The value for the external and internal hazard indices must be less than unity for the radiation hazard to be considered negligible (Beretka and Mathew, 1985). Similarly for radiological safety the value for \( H_{total} \) also must be less than unity.

Radioactivity Level Index

The radioactivity level index, \( I_y \) is usually employed to evaluate the hazardous level of radionuclides in the human body when exposed to an amount of external annual effective doses of
gamma-radiations decayed from these radioactive nuclides in soil and values of \( I_\gamma \) can be obtained using relation below

\[
I_\gamma = \frac{C_k}{1500} + \frac{C_{Th}}{100} + \frac{C_U}{150}
\]

where \( C_\text{u}, C_{\text{Th}}, \) and \( C_k \) are the activity concentrations of uranium, thorium and potassium respectively. The calculated values of \( I_\gamma \) must be less than unity for the soil environment to be free from radiological health hazards.

**Excess Lifetime Cancer Risk**

The excess lifetime cancer risk (ELCR) values are calculated using the given equation

\[
ELCR = AEDE_{\text{total}} \times D_L \times R_F
\]

where \( D_L \) is the duration of life (taken approximately as 70 years), \( R_F \) is the risk factor (Sv\(^{-1}\)), which reflects the fatal cancer risk per Sievert. For stochastic effects, a value of 0.05 for the public is recommended, (Taskin, et al, 2009).

### III. RESULTS

The activity concentration of the three (\(^{40}\text{K},^{238}\text{U}, \text{and}^{232}\text{Th}\)) natural radionuclides in the soils in study areas are presented in Tables 1, 2 and 3.

**Table 1: Activity concentrations of \(^{40}\text{K},^{238}\text{U}, \text{and}^{232}\text{Th}\) in the soil at the study sites at Ikot Ekwuo Idoro**

<table>
<thead>
<tr>
<th>Sample Point</th>
<th>K-40 (Bq/Kg)</th>
<th>U-238 (Bq/Kg)</th>
<th>Th-232 (Bq/Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>108.33±10.36</td>
<td>7.63±1.78</td>
<td>5.29±0.59</td>
</tr>
<tr>
<td>2</td>
<td>207.24±19.39</td>
<td>5.29±1.50</td>
<td>7.23±0.88</td>
</tr>
<tr>
<td>3</td>
<td>205.36±21.39</td>
<td>8.60±2.29</td>
<td>7.64±0.87</td>
</tr>
<tr>
<td>4</td>
<td>171.92±16.60</td>
<td>8.14±1.92</td>
<td>8.46±0.95</td>
</tr>
<tr>
<td>5</td>
<td>579.81±49.84</td>
<td>7.93±2.17</td>
<td>13.82±1.64</td>
</tr>
<tr>
<td>6</td>
<td>300.03±29.22</td>
<td>12.18±2.87</td>
<td>11.28±1.27</td>
</tr>
<tr>
<td>7</td>
<td>219.02±20.40</td>
<td>15.08±3.57</td>
<td>10.88±1.22</td>
</tr>
<tr>
<td>8</td>
<td>127.17±12.03</td>
<td>5.53±1.51</td>
<td>9.18±0.99</td>
</tr>
<tr>
<td>9</td>
<td>249.64±23.09</td>
<td>BDL</td>
<td>4.05±0.48</td>
</tr>
<tr>
<td>10</td>
<td>119.64±11.96</td>
<td>3.13±0.80</td>
<td>8.95±0.97</td>
</tr>
<tr>
<td>11</td>
<td>386.70±36.03</td>
<td>14.37±3.46</td>
<td>12.50±1.37</td>
</tr>
<tr>
<td>12</td>
<td>211.48±20.11</td>
<td>11.09±2.71</td>
<td>9.27±1.02</td>
</tr>
<tr>
<td>13</td>
<td>306.63±28.64</td>
<td>11.30±2.74</td>
<td>10.88±1.21</td>
</tr>
<tr>
<td>14</td>
<td>140.36±15.56</td>
<td>5.35±1.49</td>
<td>8.32±0.92</td>
</tr>
<tr>
<td>Mean</td>
<td>238.10±22.47</td>
<td>8.26±2.06</td>
<td>9.13±1.03</td>
</tr>
</tbody>
</table>

**Table 2: Activity concentrations of \(^{40}\text{K},^{238}\text{U}, \text{and}^{232}\text{Th}\) in the soil at the study sites at Ikot Ekoì**

<table>
<thead>
<tr>
<th>Sample Point</th>
<th>K-40 (Bq/Kg)</th>
<th>U-238 (Bq/Kg)</th>
<th>Th-232 (Bq/Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>67.34±6.83</td>
<td>4.19±1.13</td>
<td>10.67±1.22</td>
</tr>
<tr>
<td>2</td>
<td>89.96±8.18</td>
<td>9.11±2.11</td>
<td>6.10±0.68</td>
</tr>
<tr>
<td>3</td>
<td>78.66±7.77</td>
<td>9.36±2.70</td>
<td>6.63±0.75</td>
</tr>
<tr>
<td>4</td>
<td>35.80±3.54</td>
<td>11.09±2.78</td>
<td>10.65±1.20</td>
</tr>
<tr>
<td>5</td>
<td>26.85±2.82</td>
<td>6.26±1.32</td>
<td>4.18±0.50</td>
</tr>
<tr>
<td>6</td>
<td>68.77±6.38</td>
<td>1.03±0.28</td>
<td>7.24±0.81</td>
</tr>
</tbody>
</table>
IV. DISCUSSION

Radionuclides activity concentration in the soils samples

Tables 1, 2 and 3 show that activity concentration of $^{40}$K are 108.33±10.36 Bq/Kg to 579.81±49.84 Bq/Kg with mean of 238.10±22.47 Bq/Kg for Ikot Ekwuo Idoro, (26.85±2.82 to 180.40±18.85) Bq/Kg with mean of 73.84±7.35 Bq/Kg for Ikot Ekoi and (15.54±1.42 to 218.55±19.74) Bq/Kg with mean of 106.58±8.63 Bq/Kg for Use Ikot Amama respectively, then for $^{238}$U the range (mean) for the three sites are respectively BDL - 15.08±3.57 Bq/Kg (8.26±2.06 Bq/Kg), 1.03±0.28- 11.09±2.78 Bq/Kg(6.11±1.58 Bq/Kg) and BDL-11.10±2.78 Bq/Kg (3.16±0.80 Bq/Kg) and for $^{232}$Th the values obtained are 4.05±0.48- 13.82±1.66 Bq/Kg with mean value of 9.13±1.02 Bq/Kg, (4.18±0.50 – 10.67±1.22) Bq/Kg with mean 8.13±0.91 Bq/Kg and (4.36±0.50 – 7.67±0.84) Bq/Kg with mean of 5.91±0.66 Bq/Kg respectively. These radioactivity concentration values obtained in these quarry sites are below the world average value of 400 Bq/kg for $^{40}$K, 35Bq/kg for $^{238}$U and 30Bq/kg for $^{232}$Th (UNSCEAR, 2000), except in a one sample point at Ikot Ekwuo Idoro that the maximum value for K-40 is higher than the world value.

It could be observed from Fig.1 that the mean activity concentration of $^{40}$K is the highest for all the studied sites making $^{40}$K the dominant radionuclide in the study areas. This result agrees with the previous study elsewhere within the South South zone of Nigeria (Iwetan, et al 2015, Bede et al 2015). There is a low activity concentration of $^{232}$U in soils in all the studied areas while the activity concentration in some areas were below detection limit (BDL).

Table 3: Activity concentrations of $^{40}$K, $^{238}$U and $^{232}$Th in the soil at the study sites at Use Ikot Amama

<table>
<thead>
<tr>
<th>Sample Point</th>
<th>K-40 (Bq/Kg)</th>
<th>U-238 (Bq/Kg)</th>
<th>Th-232 (Bq/Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26.85±2.58</td>
<td>6.68±1.77</td>
<td>4.36±0.50</td>
</tr>
<tr>
<td>2</td>
<td>218.55±19.74</td>
<td>3.04±0.80</td>
<td>7.39±0.79</td>
</tr>
<tr>
<td>3</td>
<td>113.51±10.72</td>
<td>5.83±1.40</td>
<td>6.64±0.75</td>
</tr>
<tr>
<td>4</td>
<td>15.54±1.42</td>
<td>4.67±1.27</td>
<td>5.79±0.64</td>
</tr>
<tr>
<td>5</td>
<td>150.72±14.75</td>
<td>BDL</td>
<td>5.31±0.59</td>
</tr>
<tr>
<td>6</td>
<td>98.91±0.63</td>
<td>1.91±0.35</td>
<td>4.39±0.50</td>
</tr>
<tr>
<td>7</td>
<td>121.99±10.58</td>
<td>BDL</td>
<td>7.67±0.84</td>
</tr>
<tr>
<td>Mean</td>
<td>106.58±8.63</td>
<td>3.16±0.80</td>
<td>5.94±0.66</td>
</tr>
</tbody>
</table>
Radiological Hazard Indices in Soils of the Studied Areas

In Tables 4, 5 and 6 it is observed that the radium equivalent varies from 23.536Bq/kg to 64.673 Bq/kg with a mean of 39.089 Bq/kg for Ikot Ekwuo Idoro, 12.303Bq/kg to 27.554Bq/kg with a mean of 22.750Bq/kg for Ikot Ekoi and 14.982 Bq/Kg to 30.436 Bq/Kg with a mean value of 19.828 Bq/Kg for Use Ikot Amama. These values are below the world standard of 370Bq/kg for radium equivalent.

Table 4 Calculated radiological hazards indices for the soils in Ikot Ekwuo Idoro

<table>
<thead>
<tr>
<th>Sample Point</th>
<th>Ra&lt;sub&gt;eq&lt;/sub&gt; (Bq/kg)</th>
<th>ADR (nGy/h)</th>
<th>H&lt;sub&gt;ext&lt;/sub&gt;</th>
<th>H&lt;sub&gt;in&lt;/sub&gt;</th>
<th>Iγ</th>
<th>AEDE (mSv/yr)</th>
<th>Total</th>
<th>ECLR x 10&lt;sup&gt;-3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23.536</td>
<td>11.418</td>
<td>0.066</td>
<td>0.084</td>
<td>0.176</td>
<td>0.070</td>
<td>0.049</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>31.586</td>
<td>15.956</td>
<td>0.086</td>
<td>0.099</td>
<td>0.246</td>
<td>0.108</td>
<td>0.070</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>35.338</td>
<td>17.560</td>
<td>0.095</td>
<td>0.119</td>
<td>0.271</td>
<td>0.101</td>
<td>0.077</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>33.476</td>
<td>16.469</td>
<td>0.090</td>
<td>0.112</td>
<td>0.254</td>
<td>0.230</td>
<td>0.070</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>64.673</td>
<td>37.467</td>
<td>0.195</td>
<td>0.217</td>
<td>0.578</td>
<td>0.157</td>
<td>0.161</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>51.413</td>
<td>25.569</td>
<td>0.139</td>
<td>0.172</td>
<td>0.394</td>
<td>0.141</td>
<td>0.109</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>47.443</td>
<td>23.046</td>
<td>0.128</td>
<td>0.169</td>
<td>0.355</td>
<td>0.134</td>
<td>0.098</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>28.449</td>
<td>13.907</td>
<td>0.077</td>
<td>0.092</td>
<td>0.213</td>
<td>0.085</td>
<td>0.060</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>25.014</td>
<td>13.416</td>
<td>0.068</td>
<td>0.068</td>
<td>0.207</td>
<td>0.082</td>
<td>0.060</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>25.141</td>
<td>12.406</td>
<td>0.068</td>
<td>0.076</td>
<td>0.190</td>
<td>0.076</td>
<td>0.053</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>62.021</td>
<td>31.039</td>
<td>0.168</td>
<td>0.206</td>
<td>0.479</td>
<td>0.085</td>
<td>0.133</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>40.630</td>
<td>19.966</td>
<td>0.109</td>
<td>0.140</td>
<td>0.308</td>
<td>0.043</td>
<td>0.088</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>50.469</td>
<td>25.213</td>
<td>0.136</td>
<td>0.167</td>
<td>0.389</td>
<td>0.067</td>
<td>0.109</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>28.055</td>
<td>13.828</td>
<td>0.076</td>
<td>0.090</td>
<td>0.212</td>
<td>0.038</td>
<td>0.060</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>39.089</td>
<td>19.805</td>
<td>0.107</td>
<td>0.118</td>
<td>0.305</td>
<td>0.101</td>
<td>0.086</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 Calculated radiological hazards indices for the soils in Ikot Ekoi

<table>
<thead>
<tr>
<th>Sample Point</th>
<th>Ra&lt;sub&gt;eq&lt;/sub&gt; (Bq/kg)</th>
<th>ADR (nGy/h)</th>
<th>H&lt;sub&gt;ext&lt;/sub&gt;</th>
<th>H&lt;sub&gt;in&lt;/sub&gt;</th>
<th>Iγ</th>
<th>AEDE (mSv/yr)</th>
<th>Total</th>
<th>ECLR x 10&lt;sup&gt;-3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24.633</td>
<td>11.748</td>
<td>0.067</td>
<td>0.078</td>
<td>0.180</td>
<td>0.072</td>
<td>0.049</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>24.760</td>
<td>11.796</td>
<td>0.067</td>
<td>0.092</td>
<td>0.182</td>
<td>0.072</td>
<td>0.053</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>24.898</td>
<td>11.768</td>
<td>0.067</td>
<td>0.093</td>
<td>0.181</td>
<td>0.072</td>
<td>0.049</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>21.598</td>
<td>9.925</td>
<td>0.058</td>
<td>0.084</td>
<td>0.153</td>
<td>0.069</td>
<td>0.042</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>23.357</td>
<td>10.878</td>
<td>0.064</td>
<td>0.081</td>
<td>0.166</td>
<td>0.067</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>12.303</td>
<td>6.164</td>
<td>0.033</td>
<td>0.036</td>
<td>0.095</td>
<td>0.038</td>
<td>0.028</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>27.354</td>
<td>13.963</td>
<td>0.074</td>
<td>0.083</td>
<td>0.215</td>
<td>0.076</td>
<td>0.060</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>22.697</td>
<td>10.662</td>
<td>0.061</td>
<td>0.074</td>
<td>0.163</td>
<td>0.065</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>22.750</td>
<td>10.863</td>
<td>0.061</td>
<td>0.078</td>
<td>0.167</td>
<td>0.062</td>
<td>0.047</td>
<td></td>
</tr>
</tbody>
</table>

Table 6 Calculated radiological hazards indices for the soils in Use Ikot Amama

<table>
<thead>
<tr>
<th>Sample Point</th>
<th>Ra&lt;sub&gt;eq&lt;/sub&gt; (Bq/kg)</th>
<th>ADR (nGy/h)</th>
<th>H&lt;sub&gt;ext&lt;/sub&gt;</th>
<th>H&lt;sub&gt;in&lt;/sub&gt;</th>
<th>Iγ</th>
<th>AEDE (mSv/yr)</th>
<th>Total</th>
<th>ECLR x 10&lt;sup&gt;-3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14.982</td>
<td>6.895</td>
<td>0.041</td>
<td>0.059</td>
<td>0.106</td>
<td>0.042</td>
<td>0.032</td>
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<tr>
<td>2</td>
<td>30.436</td>
<td>15.588</td>
<td>0.082</td>
<td>0.090</td>
<td>0.240</td>
<td>0.096</td>
<td>0.067</td>
<td></td>
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<tr>
<td>3</td>
<td>20.848</td>
<td>10.277</td>
<td>0.056</td>
<td>0.072</td>
<td>0.158</td>
<td>0.063</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>15.162</td>
<td>6.965</td>
<td>0.041</td>
<td>0.054</td>
<td>0.107</td>
<td>0.043</td>
<td>0.032</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>19.885</td>
<td>10.314</td>
<td>0.054</td>
<td>0.054</td>
<td>0.158</td>
<td>0.063</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>17.119</td>
<td>8.584</td>
<td>0.046</td>
<td>0.051</td>
<td>0.132</td>
<td>0.053</td>
<td>0.039</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>20.361</td>
<td>10.201</td>
<td>0.055</td>
<td>0.055</td>
<td>0.158</td>
<td>0.063</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>19.828</td>
<td>9.787</td>
<td>0.054</td>
<td>0.062</td>
<td>0.151</td>
<td>0.060</td>
<td>0.044</td>
<td></td>
</tr>
</tbody>
</table>
Tables 4, 5 and 6 show the results of the calculated radiological hazard indices for each of the studied area. Absorbed dose rates vary from 11.418 nGy h\(^{-1}\) to 37.467 nGy h\(^{-1}\) with a mean of 19.805 nGy h\(^{-1}\) Ikot Ekwuo Idoro and 6.164 nGy h\(^{-1}\) to 13.963 nGy h\(^{-1}\) with a mean of 10.863 nGy h\(^{-1}\) for Ikot Eko, 6.895 nGy h\(^{-1}\) to 15.588 Gy h\(^{-1}\) with mean value 9.787 nGy h\(^{-1}\) for Use Ikot Amama. These values are below the world standard of 55.0nGy h\(^{-1}\). The mean total annual effective dose equivalent obtained was 0.101 mSv y\(^{-1}\) for Ikot Ekwuo Idoro, 0.062 mSv y\(^{-1}\) for Ikot Eko and 0.060 mSv y\(^{-1}\) for Use Ikot Amama. However, these values are within the 0.3 - 1.0 mSv y\(^{-1}\) range proposed by United Nations Scientific Committee on the Effect of Atomic Radiation (UNSCEAR) for safety. The calculated radioactivity level index values reported in Tables 4 - 6 are below the world standard value of unity hence the materials from these quarry site can be used as building materials for housing construction without posing a health threat to the inhabitants (Tufail et. al, 2007). The calculated \( H_{ext}, H_{in} \) has a value range less than unity respectively and Tables 4, 5 and 6 show the values of \( H_{Total} \) also less than unity. This indicates that interaction with the soils in Ibiono Ibom Local government area will not lead to respiratory diseases such as asthma and cancer and external diseases such as erythema, skin cancer and cataracts (Avwiri et al., 2012). The range mean excess lifetime cancer risk calculated for the studied area is between 0.044 x 10\(^{-3}\) – 0.086 x 10\(^{-3}\). These values are below the world standard of 0.29x10\(^{-3}\) implying that the probability of people in the quarry sites developing cancer cases is small (Taskin et al., 2009).

V. CONCLUSION

The evaluation of radiological hazard indices and excess lifetime cancer risk in quarry sites in Ibiono Ibom Local Government Area of Akwa Ibom State, Nigerian have been conducted. This work saves as baseline for future radiological study of the study as the government has many development programmes for these areas. The activity concentrations of \(^{40}\)K, \(^{226}\)U and \(^{232}\)Th in soil samples of Ibiono Ibom were below their respective world recommended safety limit. The radionuclides are randomly distributed in the soil with \(^{40}\)K being the dominant radionuclide. The calculated radiological hazard indices for the Ibiono Ibom are all below their respective world standards. Therefore, quarry activities and the obtained building materials do not pose any significant health threat to the environment and it’s residents. However, regular radiation monitoring and evaluation is recommended to notice any possible rise in radiation level due to the quarry activities in these areas.

REFERENCES


AUTHORS

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Design of a High Gain Circular Patch Antenna for GSM1800 Band

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Greater Kolkata College of Engineering and Management, Baruipur, 24 Parganas (SOUTH), West Bengal, India – 743302

Abstract- A GSM1800 band antenna using inverted suspended circular patch is presented in this work. The proposed antenna is suitable for some specific used such as energy harvesting systems. The main objective of simulation is to increase the gain of patch antenna. A circular patch antenna of 32 mm radius has been optimized using Ansoft HFSS.v.15. The simulation results of antenna shows the return loss is -21 dB at 1.8 GHz for VSWR≤ 2. The maximum gain of antenna is obtained at 7.5 dB. The gain of antenna is increased by inverted suspended circular patch with same dimension of radiating patch from 7.5 dB to 8.5 dB. The gain of the antenna is increased with increasing the gap between top and bottom patch because of coupling between them. The gain of antenna is increased from 8.2 dB to 8.5 dB when gap is increased from 1 mm to 4 mm.

Index Terms- Antenna, Circular Patch, GSM1800, HFSS, Inverted Suspended.

I. INTRODUCTION

In recent year harvesting of RF energy using printed patch antenna gain an attractive solution for wireless communication. RF energies are available in the frequency range of 0.86 to 2 GHz. The main sources are available in different band e.g. 869-890 MHz (CDMA), 935-960 MHz (GSM900), 1810-1880 MHz (GSM1800), 1.92-2.17 GHz (3G), 2.4-2.468 GHz (Bluetooth or WiFi ) 3.2 GHz (Radio location 3G), 3.8 GHz (LTE/4G)]1]. Generally these type signals are utilized for mobile communications. There are numbers of printed antenna has been proposed in different literature. The antenna characteristics affect the amount of receiving energy. Therefore appropriate design of antenna is very important.

This work presents the design of a circular patch antenna for GSM1800 band. Unlike rectangular patch, the Circular patch has only one degree of freedom to control it characteristics is the radius of antenna [2].The geometry and details simulation of antenna has been presented in this work. The simulation has been done using Ansoft HFSS.15 version. All parameters of antenna have optimized to obtain the maximum gain.

II. ANTENNA DESIGN

Design of proposed antenna and its parameters are shown in Figure 1. The parameters of antenna were optimized using finite element commercial software [3]. The radiating circular patch (R1=31 mm) is printed on 1.6 mm thick RogerRT/Duroid 5880 (\(\varepsilon_r=2.2\) and tan\(\delta=0.0009\)) top substrate (Ls=Ws=70 mm). A ground plane (Lg=Wg=70 mm) is printed back side of the substrate. A 50Ω coaxial cable feed (radius= 1.6 mm) is used to excite the radiating patch. Another non radiating upper circular patch (radius=32 mm) is used to increase the gain of the antenna. Non radiating circular patch is printed on superstrate (Lsup=Wsup= 70 mm) with an air gap (g) of 1 mm from radiating patch. The position of coaxial feed is optimized at distance (d) of 7 mm from the centre point of antenna.

Figure 1: Geometry of circular patch antenna (a) Front view with suspended circular patch (b) Top view without suspended circular patch

III. SIMULATION AND RESULTS OF PROPOSED ANTENNA
Radiating circular patch antenna is optimized at radius of 31 mm to obtain GSM1800 band. For a given resonance frequency, the radius of radiating circular patch can be calculated using following equations [4].

\[
f_0 = \frac{K_{nm} c}{2 \pi a_e \sqrt{\varepsilon_e}} \quad \text{(1)}
\]

Where \( f_0 \) = Resonance frequency of antenna, \( c \) = Speed of light in free space = 3x10^3 m/s, \( a_e \) = Effective radius of antenna, \( \varepsilon_e \) = Effective dielectric constant of substrate, \( K_{nm} \) is m-th root of the derivative of the Bessel function of order \( n \) [5,6]. The effective radius of antenna can be determined using equation (2).

\[
a_e = a \left[ 1 + \frac{2h}{na} \left( \ln \left( \frac{a}{2h} \right) + 1.41 \varepsilon_r + 1.77 + \frac{h}{a} (0.268 \varepsilon_r + 1.65) \right) \right]^{1/2} \quad \text{(2)}
\]

Where, \( a \) = Radius of antenna, \( h \) = Thickness of substrate and \( \varepsilon_r \) = Dielectric constant of substrate. For the fundamental TM11 mode, the value of \( K_{nm} \) mode is 1.84118. The value of \( \varepsilon_e \) can be calculated using equation (3).

\[
\varepsilon_e = \frac{C(a,h,\varepsilon_r,\varepsilon_0)}{C(a,h,\varepsilon_0)} \quad \text{(3)}
\]

\( C(a,h,\varepsilon_r,\varepsilon_0) \) and \( C(a,h,\varepsilon_0) \) are total capacitance of antenna with and without dielectric substrate respectively. \( C(a,h,\varepsilon_r,\varepsilon_0) \) of antenna can be calculated using equation (4).

\[
C(a,h,\varepsilon_r,\varepsilon_0) = \frac{0.8525 \varepsilon_r \varepsilon_0 \pi a^2}{h} + 0.5 C_f \quad \text{(4)}
\]

\( C_f \) can be calculated using equation (5).

\[
C_f = 2a \varepsilon_0 \left[ \ln \left( \frac{a}{2h} \right) + 1.41 \varepsilon_r + 1.77 + \frac{h}{a} (0.268 \varepsilon_r + 1.65) \right] \quad \text{(5)}
\]

\( C(a,h,\varepsilon_0) \) can be calculated for air. Calculated radius is well agreed with simulated radius of radiating circular patch. Results are not affected if effective permittivity \( (\varepsilon_e) \) is considered as slightly less than relative permittivity of the substrate instead of calculations using mathematical equations.

**A. Return loss:**

Antenna is optimized at radius (R1) of 32 mm and feed point at distance (d) of 7 mm from the centre point of antenna. Simulation results shows that return loss is S11 = -21dB and input impedance is 48Ω are shown on the Figure 2 and Figure 3 respectively. The antenna has approximately 1% (154 MHz) bandwidth for VSWR≤2 from 1.7934 GHZ to 1.8086 GHz.

**B. Co-Pol and Cross-Pol:**

With the increasing of the thickness of substrate 1.6 mm to 2 mm, the co-pol and and cross pole both are increasing. But at the thickness of 3 mm, the co-pol and cross-pol both are decreasing. The RogerRT /Duroid 5880 is considered as substrate material for simulation of Co-pol and Cross-pol at 1.8 GHz. Table I. is showing Co-pol and Cross-pol with different thickness of substrate. Co-pol and Cross-pol radiation pattern are shown in Figure 4 and Figure 5 respectively. The gain pattern of antenna is shown in the figure 6.
Figure 4: Co-Pol and Cross-Pol radiation pattern at Phi= 90°.

Figure 5: Co-Pol and Cross-Pol radiation pattern at Phi= 0°.

Table II: Gain of antenna with different dielectric constant.

<table>
<thead>
<tr>
<th>Substrate Materials</th>
<th>Dielectric Constant (ε_r)</th>
<th>tanδ</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RogerRT/Duroid(5880)</td>
<td>2.2</td>
<td>0.0009</td>
<td>7.5</td>
</tr>
<tr>
<td>RogerRT/Duroid(5870)</td>
<td>2.33</td>
<td>0.0012</td>
<td>7.2</td>
</tr>
<tr>
<td>RogerRT/Duroid(6002)</td>
<td>2.94</td>
<td>0.0012</td>
<td>6.7</td>
</tr>
</tbody>
</table>

IV. ANTENNA SIMULATION WITH INVERTED SUSPENDED CIRCULAR PATCH

Since the bandwidth of antenna is very small. A non radiated circular patch is suspended in air in the top of the radiating circular patch to increase the bandwidth of antenna. The top circular patch is inverted suspended on a dielectric superstrate. The dimension of top patch is same as radiating and they are electromagnetically coupled. The RogerRT/Duroid (5880) superstrate has thickness (h_sup) of 1.6 mm with ε_r=2.2 and tanδ=0.0009. The gap between radiating patch and non-radiating patch is g. The variation of Co-pol, Cross-pol, bandwidth and gain of the antenna with different value of g is shown on the Table III.

Table III: The variation of Co-Pol, Cross-Pol, Bandwith and Gain of the antenna with different value of g.

<table>
<thead>
<tr>
<th>Gap (g)</th>
<th>Phi=0°,H-Plane</th>
<th>Phi=90°,E-Plane</th>
<th>Bandwidth</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mm</td>
<td>2.9 -34</td>
<td>2.9 -34</td>
<td>70 MHz</td>
<td>8.2</td>
</tr>
<tr>
<td>2 mm</td>
<td>3.3 -52</td>
<td>3.3 -52</td>
<td>128 MHz</td>
<td>8.3</td>
</tr>
<tr>
<td>3 mm</td>
<td>3.2 -50</td>
<td>3.2 -46</td>
<td>158 MHz</td>
<td>8.4</td>
</tr>
<tr>
<td>4 mm</td>
<td>3.4 -52</td>
<td>3.4 -51</td>
<td>174 MHz</td>
<td>8.5</td>
</tr>
</tbody>
</table>

The top patch is electromagnetically coupled with bottom patch which increase the bandwidth of antenna. The effective dielectric constant under top patch is low which increase the gain of antenna. This suspended configuration of antenna provides a dielectric cover for the actual antenna [7,8]. As the coupling between top and bottom patch decreases with increases the gap (g) [9], both the Co-pol and Cross-pol are increasing.

V. CONCLUSION

In this work, a narrow band patch antenna has been presented for GSM1800 band. This antenna can be used to harvest electromagnetic energy from cell tower. A rectifier circuit is needed to convert RF ac signal to dc signal. A rectifier circuit can be designed according to resonance frequency of antenna using diode network.

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REFERENCES


[3]. Ansoft HFSS V.15-Software based on finite element method, ver.15, ANSYS.


[7]. J.D. Kraus, R.J. Marhefka and Ahmad S Khan, Antenna and Wave Propagation, McGraw Hill Education (India), 2013


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Comparison of Intercostal Stretch Technique Versus Diaphragmatic Breathing on Dyspnoea, Chest Expansion And Functional Capacity in Stable Copd

Dangi Ashwini, Sheth Bhagyashri, Deo Medha

** Abstract- Background**: The use of diaphragmatic breathing and various proprioceptive neuromuscular facilitation (PNF) techniques has become more prevalent in cardiorespiratory physiotherapy to improve pulmonary functions. However, limited evidence exists regarding evaluation of their effectiveness in stable COPD. Hence, the objective of the study was to evaluate and compare the effectiveness of intercostal stretch technique versus diaphragmatic breathing on dyspnoea, chest expansion and functional capacity in stable COPD.

**Methodology**: Eighteen subjects were recruited based on inclusion and exclusion criteria. Dyspnoea score, chest expansion at three levels and 6 minute walking distance (6MWD) were obtained. Subjects were, then, randomly assigned to two groups. In group A, subjects underwent PNF technique using intercostal stretch for ten breaths in expiratory phase in supine lying position along with conventional chest physiotherapy, while in the group B, diaphragmatic breathing was given along with conventional chest physiotherapy.

**Result**: Intragroup analysis of dyspnoea score showed a very significant change in both groups (p=0.0039), 6MWD showed a very significant change (p=0.0028) in group A and a significant change in group B (p=0.0196), chest expansion changed non significantly at the axillary level (p=0.1690), extremely significantly at nipple level (p=0.0005) and at xiphisternal level (p<0.0001) in group A while it changed non-significantly (p=0.0805) at the axilla level, very significantly (p=0.0081) at nipple level and extremely significantly (p<0.0001) at xiphisternal level in group B. Intergroup analysis of dyspnoea score, 6MWD and chest expansion at all three levels showed a non significant change.

**Conclusion**: Both intercostal stretch technique and diaphragmatic breathing are equally effective in reducing dyspnoea, improving chest expansion and functional capacity in stable COPD.

**Index Terms**: Diaphragmatic breathing, Dyspnoea, Chest expansion, COPD, Intercostal stretch

I. INTRODUCTION

**Chronic obstructive pulmonary disease (COPD)** is a preventable and treatable disease characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and is associated with an abnormal inflammatory response of the lungs to noxious particles or gases, primarily caused by cigarette smoking. COPD is the 4th leading cause of death worldwide and is expected to be the 3rd leading cause of death in the next 20 years.

The pathology of COPD includes inflammation and structural changes to all anatomical regions of the lung. Loss of bronchio –alveolar attachments leads to reduction of the elastic support normally given to the airways to maintain their patency, especially during expiration.

These abnormalities could all contribute to muscle weakness, particularly at sub-maximal activation, even in patients with mild to moderate COPD contributing to increased anatomical dead space in the lungs & dynamic hyperinflation that increase in end-expiratory lung volume (EELV) that may occur in patients with airflow limitation when minute ventilation increases. Obstruction causes ventilation perfusion mismatch resulting in hypercapnia, hypoxemia and increased oxygen demand leading to dyspnoea. Dyspnoea is the most common symptom of COPD.

The Medical Research Council (MRC) dyspnoea scale has been in use for many years for grading the effect of breathlessness on daily activities. The MRC dyspnoea scale is a simple and valid method of categorizing patients with COPD in terms of their disability.

Majority of studies dealing with factors contributing to inspiratory muscle weakness in COPD have focused on the diaphragm, mainly because the diaphragm is the principle muscle of inspiration. Patients with COPD have a lower transdiaphragmatic pressure generating lower capacity than healthy subjects, which has been described as hyperinflation-induced diaphragm shortening, placing the diaphragm at a mechanical disadvantage leading to reduced chest expansion.

Patients with COPD are markedly inactive in daily life due to dyspnoea and reduced chest expansion leading to a downward spiral of symptom-induced inactivity, causing deconditioning and muscle weakness which results in spending less and less time walking and standing compared with sedentary healthy elderly subjects leading to a reduction in functional capacity. Consequently, exercise testing is increasingly being used in the functional assessment of COPD patients.

A recent review of functional walking tests concluded that “the 6MWT is easy to administer, better tolerated and more
reflective of activities of daily living than the other tests and it is practically simple.7

Diaphragmatic breathing is the normal mode of respiration. It moves the abdominal wall predominantly during inspiration to reduce upper rib cage motion which causes relaxation of the accessory muscles and thus decreases the work of breathing8,9. Several studies have been done to assess the effectiveness of diaphragmatic breathing in COPD patients.10,11

Proprioceptive Neuromuscular Facilitation (PNF) is a form of stretching in which a muscle is alternatingly stretched passively and contracted. The technique targets nerve receptors of a muscle to extend its length. It is usually a combination of passive stretching and isometric contraction. PNF is used to develop muscle strength, endurance, facilitate mobility, stability, control and coordinated movement and lays a foundation for the restoration of function. In addition, PNF also is known to improve lung functions. The facilitatory stimuli are intercostal stretch, vertebral pressure to the upper thoracic spine, vertebral pressure to the lower thoracic spine, anterior stretch lift to the posterior basal area, moderate manual pressure, perioral pressure, abdominal co-contraction. Intercostal stretch is effective in restoring normal breathing pattern, proving beneficial in improving the chest wall mobility and thus improving chest expansion12. Vikram Mohan (2012) assessed the effect of intercostal stretch on pulmonary functions in healthy males13. It showed an improved lung volume & pulmonary functions with intercostal stretch. PNF was compared with respiratory muscle resistance training on respiratory rate during weaning off phase of mechanical ventilation in another study by (Sharma Rajiv et al, 2010)14. It was seen that respiratory rate reduced significantly with PNF training.

Very few studies are done to evaluate the effects of intercostal stretch versus diaphragmatic breathing on dyspnoea, chest expansion & functional capacity in COPD patients according to our knowledge and hence the purpose of this study was to compare the effectiveness of intercostal stretch versus diaphragmatic breathing in stable COPD.

II. METHODOLOGY

18 Patients diagnosed with COPD were selected to participate in this Prospective Randomized Intervventional Trial.

Inclusion Criteria:

1. Subjects with FEV1 between 50 - 80% according to GOLD criteria
2. Subjects with no acute exacerbation in the past 4 months
3. Both males and females between the age group of 50 - 70 years

Exclusion Criteria:

1. Haemodynamically unstable subjects and those in acute exacerbation of COPD
2. Subjects already performing chest physical therapy
3. Subjects unwilling to participate in the study

All subjects were between the age group of 55-65 years with a mean age of 61.555 ± 3.127 They were informed about the nature of the study and a written consent was taken. Ethical clearance was obtained from the local ethical committee before beginning with the study. Demographic data of the subjects was obtained. The dyspnoea score was obtained using the MRC dyspnoea scale, chest expansion was measured at the anterior axillary fold, nipple and the xiphisternal levels with a measure tape and six minute walking distance (6MWD) was calculated using six minute walk test.

Subjects were then, randomly divided through a draw system into group A and group B. Subjects in group A were given PNF in the form of intercostal stretch in supine position by applying pressure to the upper border of 3rd rib in a downward direction that will widen the intercostal space above it. The application of the stretch was timed with exhalation phase and the stretched position was then maintained as the patient continued to breathe in his usual manner. This technique was given from the 3rd rib to the 8th rib along with conventional chest physiotherapy twice a day, 5 days in a week for 4 weeks. Subjects in group B were given diaphragmatic breathing in semi Fowler position and one hand was placed over the rectus abdominis just below the anterior costal margin. Subject was asked to breathe in slowly and deeply through the nose by keeping the shoulders relaxed and upper chest quiet, allowing the abdomen to rise slightly and then they were instructed to relax and exhale slowly through the mouth. The technique was also given along with conventional chest physiotherapy twice a day, 5 days in a week for 4 weeks. Dyspnoea score was obtained again at the end of 4 weeks using the MRC dyspnoea scale, chest expansion was measured again at the 3 levels mentioned above & 6 minute walking distance was calculated by the 6 minute walk test. Data obtained was then statistically analyzed.

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III. RESULTS

In the present study, we compared the PNF technique in the form of intercostal stretch versus diaphragmatic breathing on dyspnoea score, chest expansion at 3 levels & 6 minute walking distance in stable COPD patients.

Graph pad prism6 was used for statistical analysis in this study. To determine the statistical significance, p value was set as p < 0.05. All data presented as mean ± standard deviation. Baseline characteristics were determined for all the outcome measures

Table 1: Baseline analysis of group A and B

<table>
<thead>
<tr>
<th>Parameters</th>
<th>GROUP A</th>
<th>GROUP B</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>61.555 ± 3.127</td>
<td>61.111 ± 4.595</td>
<td></td>
</tr>
<tr>
<td>Number of males</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Number of females</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Mean duration of COPD (years)</td>
<td>7.000 ± 4.031</td>
<td>7.111 ± 3.951</td>
<td></td>
</tr>
<tr>
<td>Number of smokers</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Number of non-smokers</td>
<td>7</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Dyspnoea score was compared pre & post intervention in both groups using Wilcoxon signed rank test while the post intervention dyspnoea scores of both groups were compared using Mann Whitney U test. Student t test was used to analyze six minute walking distance & chest expansion values both within groups and between groups. The pre intervention score of dyspnoea on MRC scale (p value = 0.9592), six minute walking distance (p value = 0.7000) and the chest expansion at the axilla level (p value = 0.7513), nipple level (p value = 0.8581) and xiphisternal level (p value = 0.7513) between both the groups was not statistically significant which showed that both the groups were homogenous.

Table 2: Comparison of dyspnoea score, 6MWD and chest expansion at 3 levels pre and post intervention in group A

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pre</th>
<th>Post</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspnoea score</td>
<td>2.444 ± 0.5270</td>
<td>1.555 ± 0.5270</td>
<td>0.0039</td>
</tr>
<tr>
<td>6 MWD (metres)</td>
<td>501.111 ± 43.141</td>
<td>511.111 ± 42.557</td>
<td>0.0028</td>
</tr>
<tr>
<td>Chest expansion – axilla level (inches)</td>
<td>1.1333 ± 0.1500</td>
<td>1.1555 ± 0.1333</td>
<td>0.1690</td>
</tr>
<tr>
<td>Chest expansion – nipple level (inches)</td>
<td>1.0444 ± 0.1590</td>
<td>1.1555 ± 0.1424</td>
<td>0.0005</td>
</tr>
<tr>
<td>Chest expansion – xiphisternal level (inches)</td>
<td>0.8666 ± 0.1500</td>
<td>1.0444 ± 0.1130</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

After 4 weeks of intervention, dyspnoea score showed a statistically very significant change (p value = 0.0039), 6MWD also showed a statistically very significant change (p value = 0.0028). However, chest expansion in group A at axillary level showed a non-significant change (p value = 0.1690), at the nipple level showed extremely significant change (p value = 0.0005) and at the xiphisternal level, also showed extremely significant change (p value < 0.0001) following 4 weeks of intervention.
Table 3: Comparison of dyspneoa score, 6MWD and chest expansion at 3 levels pre and post intervention in group B

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pre</th>
<th>Post</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspneoa score</td>
<td>2.444 ± 0.5270</td>
<td>1.666 ± 0.5000</td>
<td>0.0039</td>
</tr>
<tr>
<td>6 MWD (metres)</td>
<td>493.333 ± 40.927</td>
<td>503.333 ± 42.793</td>
<td>0.0196</td>
</tr>
<tr>
<td>Chest expansion – axilla level (inches)</td>
<td>1.1444 ± 0.1424</td>
<td>1.1777 ± 0.1302</td>
<td>0.0805</td>
</tr>
<tr>
<td>Chest expansion – nipple level (inches)</td>
<td>1.0333 ± 0.1225</td>
<td>1.1111 ± 0.1167</td>
<td>0.0081</td>
</tr>
<tr>
<td>Chest expansion – xiphisternal level (inches)</td>
<td>0.9111 ± 0.1833</td>
<td>1.0444 ± 0.1667</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

After 4 weeks of intervention, dyspneoa score showed a statistically very significant change in (p value = 0.0039), 6MWD also showed a statistically significant change (p value > 0.0196). Chest expansion, when measured in group B after 4 weeks of intervention, showed a non-significant change (p value = 0.0805) at the axillary level, a very significant change (p value = 0.0081) at the nipple level and showed an extremely significant change (p value < 0.0001) at the xiphisternal level.

Table 4: Comparison of dyspneoa score, 6MWD and chest expansion at 3 levels post intervention between groups A & B

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group A</th>
<th>Group B</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspneoa score</td>
<td>1.555 ± 0.5270</td>
<td>1.666 ± 0.5000</td>
<td>0.6762</td>
</tr>
<tr>
<td>6 MWD (metres)</td>
<td>511.111 ± 42.557</td>
<td>503.333 ± 42.793</td>
<td>0.7041</td>
</tr>
<tr>
<td>Chest expansion – axilla level (inches)</td>
<td>1.1555 ± 0.1333</td>
<td>1.1777 ± 0.1302</td>
<td>0.7252</td>
</tr>
<tr>
<td>Chest expansion – nipple level (inches)</td>
<td>1.1555 ± 0.1424</td>
<td>1.1111 ± 0.1167</td>
<td>0.4793</td>
</tr>
<tr>
<td>Chest expansion – xiphisternal level (inches)</td>
<td>1.0444 ± 0.1130</td>
<td>1.0444 ± 0.1667</td>
<td>&gt; 0.9999</td>
</tr>
</tbody>
</table>

Dyspneoa score between both the groups after 4 weeks of intervention showed a non-significant change (p value = 0.6762) 6MWD between both the groups showed a non-significant change (p value = 0.7041) after 4 weeks of intervention.

Chest expansion at the axillary level (p value = 0.7252), nipple level (p value = 0.4793) and xiphisternal level (p value > 0.9999) also showed a non-significant change after 4 weeks of intervention between both the groups.

IV. DISCUSSION

COPD is a lung disease defined by persistently poor airflow as a result of breakdown of lung tissue and dysfunction of the small airways usually followed by dyspnea, fatigue, and sputum production.15 Abnormalities in small airways and destruction of lung parenchyma contribute to the development of airflow limitation with a consequent reduction of lung elastic recoil leading to dynamic hyperinflation and thus shortness of breath2.

Intercostal muscles help in upward and outward movement of the ribs which results in increase in the anterior posterior diameter of the thoracic cavity. It helps both in inspiration and forced expiration.13,16 It is seen that due to dyspnea, the physical activities in COPD patients are reduced. This will have an impact on the oxidative capacity of the skeletal muscles and it will reduce the proportion of muscle fibers from type I to type II. Hence, it can be hypothesized that intercostal muscles which aids in the mechanical aspects of breathing may undergo atrophy when there is a poor physical activity. Therefore, this could have an impact on chest wall mobility and chest expansion in COPD leading to dyspnea13.

Chest expansion reduces due to decrease in the chest wall mobility and reduced lung compliance. Intercostal stretch may enhance the chest wall elevation and thus increase expansion to improve intra-thoracic lung volume which contributes to improvement in flow rate percentage. This may contribute to the increase in ventilatory capacity such as tidal volume, minute ventilation and oxygen status, thus improving the chest expansion, hyperinflation and air trapping, in turn reducing dyspnea. The changes in ventilatory parameters may be due to the firing discharge of the muscle spindle during a passive stretch phase.13,17 Intercostal stretching may have activated the stretch receptors in the chest wall, thereby distending the thorax which could be neurologically linked to medulla with efferent nerve cells.13

Diaphragm is the primary muscle of ventilation accounting for approximately 70% to 80% of the inspiration during quiet breathing. The thoracoabdominal movement during quiet inspiration is a result of the pressures that are generated by the contraction of the diaphragm, the shape of the diaphragm and angle of pull of its fibres. In COPD, the costal fibres of diaphragm become more horizontally aligned due to hyperinflation so that the further contraction of diaphragm no longer lifts the lower rib cage in a bucket handle movement. This leads to paradoxical breathing in which the lower rib cage is pulled inwards during inspiration.18 Thus, there is an alteration in the mechanical efficiency of diaphragm in COPD.

During diaphragmatic breathing, the abdomen becomes the fulcrum and lifts the lower rib cage and rotate it outwards, reducing dynamic hyperinflation of the rib cage and improving gas exchange, thus optimizing the pattern of thoraco abdominal motion.18,19 The idea behind decreasing dynamic hyperinflation of the rib cage is that this intervention will presumably result in diaphragm working over a more advantageous part of their length-tension relationship.20
Moreover, diaphragmatic breathing is expected to decrease the elastic work of breathing, because the chest wall moves over a more favourable part of its pressure volume curve. This may be responsible for reducing the work load on the inspiratory muscles along with the sensation of dyspnoea. Since the diaphragm has its major attachment at the xiphisternum, it could be the probable reason for a significant improvement of chest expansion at the xiphisternal level in this study.

With intercostal stretching and diaphragmatic breathing, the lung compliance and the chest wall mobility is improved. This may be the reason for an improved pulmonary ventilation thus, indirectly increasing the functional capacity.

V. LIMITATIONS

A possible limitation with this study is that the sample size is small. Also the duration of intervention is only 4 weeks. Another limitation is that a long - term follow up was not done. Hence the long – term beneficial effects of both intercostal stretch and diaphragmatic breathing exercises are not clearly known.

Hence, it can be recommended that a similar study can be carried out with a larger sample size and with a longer duration of intervention. Also a follow up after a period of 3 to 6 months may be done to ascertain the long – term effects of both the techniques in COPD patients.

VI. CONCLUSION

Thus, it can be concluded from the present study, that both PNF technique in the form of intercostal stretch and diaphragmatic breathing are equally effective in reducing dyspnoea, improving chest expansion and increasing the functional capacity in stable COPD. Hence, both the techniques can be incorporated in the rehabilitation program for stable COPD patients. However, intercostal stretch can be performed only by a therapist while diaphragmatic breathing exercises can be given as a part of a home program as it is easy for the patient to understand and learn and can be done daily without supervision.

REFERENCES


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Determinants of Profitability of Airlines in the Aviation Industry in Kenya

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** Jomo Kenyatta University of Agriculture and Technology, Kenya
*** Jomo Kenyatta University of Agriculture and Technology, Kenya

Abstract- The objective of the study was to establish determinants for the profitability margins at Kenya Airlines in the aviation industry. The study objective of the study was to establish the extent of which management structure had on the airlines profit. The Kenya airlines over period of time from the year 2007 have experienced low profitability margins causing shareholders loss on their wealth, it further resulted to low pricing and devaluing of the Kenya Airlines wealth capital accumulation and the losses resulted to retrenchment of workers/employees and low GDP growth contribution. The target population were all the airlines in Kenya, thus a census study was conducted from 273 managers from the top, middle and functional levels were sampled though the use of questionnaires. Several sampling techniques were used that is the non-probability design through the use of both purposive and convenience and probability. The study used the descriptive research design, and data was collected through the use of questionnaires (structured and unstructured) to collect both primary data and secondary data be used. The data was analyzed and presented through use of descriptive analysis, probit regression, content analysis and the SPSS version 20 was used to analyse the content of the study. The study found that all the variables of the study had a positive impact on the profitability of airlines in the aviation industry in Kenya and thus they were statistically significant according to the findings of the study. In conclusion the study recommended several actions that need to be considered for the airline to return to paths of profitability. That is; there is need for airlines to implement prices that are inexpensive to passengers, the management structure effect on performance should be implemented appropriately because their decisions have effect on profitability.

Index Terms- Kenya Aviation, Profitability, Management Structure

I. INTRODUCTION

The airline industry has lost $42 billion over the past five years. All of this is accounted for by US airlines. On average over the past five years airlines in the rest of the world have broken even (Pearce, 2005) however, globally airline profitability improved significantly in the year 2006 from airlines strong revenue growth, cost efficiencies and capacity management. Industry-wide operating profit is estimated to have increased from $4.3 billion in 2005 to $13.0 billion in 2006 translating to a 2.9% operating profit margin. The US airlines had the strongest improvement in operating profitability. Twelve US airlines made operating profits of more than $100 million (compared to 5 in the year 2005), while only four US airlines made operating losses (compared to 9 airlines in the year 2005). Nevertheless, local currency profits also increased at several European and Asia-Pacific network airlines, which remain among the highest profit generators (IATA, 2007). Despite the clear value being created for customers, the airline industry has found it difficult to make an adequate level of profits. It is also the case that network airline profitability has been lowest on the more mature N. American and European regions. However, none have managed to generate a ROIC sufficient to meet the minimum expectations of the investors. Airlines from all regions and business models, over the last full business cycle, generated average ROICs below their Weighted Average Cost of Capital (WACCs). There has been only a minor improvement in returns for investors in airlines over this past business cycle. During the period 2004-2011 returns on invested capital in the worldwide airline industry averaged 4.1%. This compares with an average of 3.82% during 1996-2004. (IATA, 2011).

II. STATEMENT OF THE PROBLEM

Although aviation contributes 1.1 % in Kenya GDP which is ksh 24.8 billion, where by the airlines services provides Ksh 13.0 billion, (Oxford Economics, 2011), the airlines sectorial growth rate and its contribution to growth rate has been fluctuating that is the year 2005 at 5.2%, year 2006 at 9.0%, the year 2007 at 7.2%, the year 2008 at 0.1% the year 2009 at 4.0%, the year 2010 at 6.9%, the year 2011 at 5.4%, the year 2012 at 3.3% and the year 2013 at 3.6%, (Delloite, 2011& ROK, 2014). The contribution of GDP by sector for instance the Kenya airlines in transport sector dropped from 11.6% in 2008 to 10.4% in 2012, (Odero & Reeves, 2014). Although most of the research has been done on Kenya airways that is Mulei (2011) focused on corporate governance, Mwikya (2013) studied on time service delivery at airline, kweyu (2010) looked at corporate culture, Irungu (2012) focused on information technology as a result none of this studies took an in-depth analysis on the factors that contribute to profitability margins of Kenya airlines as an industry hence the purpose of this study to fill the gap.

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III. GENERAL OBJECTIVE

To establish the strategic determinants of profitability of airlines in the aviation industry sector in Kenya.

Specific Objectives

The specific objective of this study was to establish the extent to which management structure determines profitability of Kenyan airlines in the aviation industry.

IV. RESEARCH METHODOLOGY

This study used both the census and descriptive mode of study as evident in the research conducted by Nderu, (2013), on Influence of Survival Strategies on the Organizational Performance of Kenya Airways and Irene, (2012), on the Influence of Information and Communication Technology on Performance of Aviation Industry - A Case Of Kenya Airways Ltd. A population is termed either as finite if it consists of a fixed number of elements such that it is possible to enumerate it in its totality and it is represented by the symbol N, or a population is termed as infinite if theoretically it is impossible to observe all the elements (Kothari, 2004). The population of the study was all the local airline companies in the aviation industry in Kenya (Maina, 2014) which employs 6000 employees who directly work in the Kenya aviation Industry (Oxford Economics, 2011). The study used the stratified sampling technique this is the process whereby sample is constrained to include elements from each of the segment (Cooper & Schindler, 2006). The study employed the use of questionnaires; this is because they provide confidentiality, and an avenue through which information can be collected from a large sample and from diverse regions (Kombo & Tromp, 2006). The research used both the primary source of data by carrying out interviews and questionnaires to respondents to solicit for information, also secondary source of data was used that is from electronically stored information from Kenya airlines websites, financial statements, information from the International Air Travel Association (IATA), Kenya Civil Aviation authority, Kenya’s Parliamentary Senatorial Enquiry Report and information from journals. The use of secondary source of data is that it is available more cheaply, the existing data is readily available in a convenient way and form, hence saves on time because of the availability of pre-processed data (Kombo & Tromp, 2006).

V. RESULTS AND DISCUSSIONS

The statistical Probit on table below analysis outputs for the above variables. The P-Values all show that there is no significant relationship between management and the airlines profitability. Management ownership has a P-Value of 0.864, .048 for management profits, 0.165 for management’s effects to profits, and .0950 for managements drive for profits. All this is at 95% Confidence interval, and 0.05 alpha. Since the significance values are above alpha, then there are no significant relationships between the management factors and the various airlines profitability levels. The findings of the study concur with the research by Benny and Jen-Hung (2012) in the examination of the determinants of profitability in the U.S. domestic airline industry, the study considered operations strategy, productivity, and service measures, as variables while focusing the attention on the effects of the 9/11 attack. The study concluded that operations strategy measures are important factors in explaining profitability. More so, with regard to productivity measures, the study found that Loading Factor has a positive and a significant coefficient in predicting profitability. The board’s composition also plays a greater role in the performance of an organization. Supervisory role performed by non executive directors helps the company to be efficiently managed and they result to higher governance scores thus a higher market value of a firm’s value in the market (Chen, 2008; Black, Hasung, & Woochan, 2006). Firms with weaker governance structures face more agency problems and managers of those firms get more private benefits due to weak governance structure (Core et al, 1999).Good governance and administration practices are important in reducing risk for investors, attracting investment capital and improving the performance of companies (Velmampy & Pratheekanth, 2012), besides it provides a better access to financing and lower cost of capital.

### Profits on Management Structure Probit Variance Explained

<table>
<thead>
<tr>
<th>Parameter Estimates</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>Z</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management ownership</td>
<td>.034</td>
<td>.197</td>
<td>.171</td>
<td>.864</td>
<td>-.352 to .420</td>
</tr>
<tr>
<td>Management profits</td>
<td>.373</td>
<td>.189</td>
<td>1.979</td>
<td>.048</td>
<td>.004 to .743</td>
</tr>
<tr>
<td>Management affects profit</td>
<td>-.403</td>
<td>.291</td>
<td>-1.388</td>
<td>.165</td>
<td>-.973 to .166</td>
</tr>
<tr>
<td>Management drive profit</td>
<td>-.010</td>
<td>.157</td>
<td>-.063</td>
<td>.950</td>
<td>-.317 to .297</td>
</tr>
<tr>
<td>Intercept</td>
<td>10</td>
<td>.234</td>
<td>.108</td>
<td>.914</td>
<td>-.208 to .259</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>.217</td>
<td>-.456</td>
<td>.648</td>
<td>-.316 to .118</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>.232</td>
<td>1.874</td>
<td>.061</td>
<td>.203 to .667</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>.266</td>
<td>.793</td>
<td>.428</td>
<td>-.055 to .477</td>
</tr>
</tbody>
</table>

a. PROBIT model: PROBIT(p) = Intercept + BX (Covariates X are transformed using the base 2.718)

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VI. CONCLUSION

The first objective was to determine whether management structure had an effect on the Profitability of Kenyan airlines in the aviation industry. The majority of airlines operating in Kenya are private individual, private partnership and public owned. These airlines have constituted boards to manage their operations in the flight industry. The management according to the respondents, their actions and decisions do affect the airline profitability margins. This is because they determine the pricing mechanism which in turn affects profits. The study showed that the pricing mechanism and tools used in determining the airlines prices rates and tickets are eschewed to be expensive as compared to other international airlines that operate in Kenya. As a result these prices deter most passengers from using the airlines as a result they opt for other airline carriers. Apart from the management on the higher cadre, those on the lower management level usually do not have the benefit of making sound nor contribute to the major decisions yet majority of them are usually on the ground level and they know more about what issues need to be incorporated to the management to have sound performance of airlines. Most respondents agreed that airlines have visions but they have less impact on the profitability of airlines since these visions have not been ingrained in the day to day operational requirement of the work load at hand. Besides it was agreed that the visions do not have a bearing on the profitability of airlines. Thus effectiveness of leadership on a business is measured by how airlines are able to steer themselves to operate on the path of profitability. When this aspect is not visible it is therefore assumed that the leadership is not so robust in managing the variances that determine the airlines performance. The Probit regression and correlation results indicated that there was a positive and significant relationship between management structure and profitability of airlines in aviation industry in Kenya. The findings imply that management structure were statistically significant in explaining the profitability of airlines in aviation industry.

REFERENCES


AUTHORS

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Third Author – George Orwa(PhD)- Jomo Kenyatta University of Agriculture and Technology, Kenya

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Determinants of Profitability of Airlines in the Aviation Industry in Kenya

Enos Bernabas Anene Jomo *, Margaret Oloko **, George Orwa ***

* PhD student- Kenyatta University of Agriculture and Technology, Kenya
** Jomo Kenyatta University of Agriculture and Technology, Kenya
*** Jomo Kenyatta University of Agriculture and Technology, Kenya

Abstract - The objective of the study was to establish determinants for the profitability margins at Kenya Airlines in the aviation industry. The study objective of the study was to establish the extent of which innovation and knowledge had on profitability level. The Kenya airlines over period of time from the year 2007 have experienced low profitability margins causing shareholders loss on their wealth, it further resulted to low pricing and devaluing of the Kenya Airlines wealth capital accumulation and the losses resulted to retrenchment of workers/employees and low GDP growth contribution. The target population were all the airlines in Kenya, thus a census study was conducted from 273 managers from the top, middle and functional levels were sampled though the use of questionnaires. Several sampling techniques were used that is the non-probability design through the use of both purposive and convenience and probability. The study used the descriptive research design, and data was collected through the use of questionnaires (structured and unstructured) to collect both primary data and secondary data be used. The data was analyzed and presented through use of descriptive analysis, probit regression, content analysis and the SPSS version 20 was used to analyse the content of the study. The study found that all the variables of the study had a positive impact on the profitability of airlines in the aviation industry sector in Kenya. Thus they were statistically significant according to the findings of the study. In conclusion the study recommended several actions that need to be considered for the airline to return to paths of profitability. That is; there is need for airlines to increase on their innovation capability to have competitive advantage edge on the market environment.

Index Terms - Kenya Aviation, Profitability, Innovation, Knowledge

I. INTRODUCTION

The airline industry has lost $42 billion over the past five years. All of this is accounted for by US airlines. On average over the past five years airlines in the rest of the world have broken even (Pearce, 2005) however, globally airline profitability improved significantly in the year 2006 from airlines strong revenue growth, cost efficiencies and capacity management. Industry-wide operating profit is estimated to have increased from $4.3 billion in 2005 to $13.0 billion in 2006 translating to a 2.9% operating profit margin. The US airlines had the strongest improvement in operating profitability. Twelve US airlines made operating profits of more than $100 million (compared to 5 in the year 2005), while only four US airlines made operating losses (compared to 9 airlines in the year 2005). Nevertheless, local currency profits also increased at several European and Asia-Pacific network airlines, which remain among the highest profit generators (IATA, 2007).

Despite the clear value being created for customers, the airline industry has found it difficult to make an adequate level of profits. It is also the case that network airline profitability has been lowest on the more mature N. American and European regions. However, none have managed to generate a ROIC sufficient to meet the minimum expectations of the investors. Airlines from all regions and business models, over the last full business cycle, generated average ROICs below their Weighted Average Cost of Capital (WACCs). There has been only a minor improvement in returns for investors in airlines over this past business cycle. During the period 2004-2011 returns on invested capital in the worldwide airline industry averaged 4.1%. This compares with an average of 3.82% during 1996-2004. (IATA, 2011).

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V. RESULTS AND DISCUSSIONS

A Probit analysis was carried out to find out the relationship between the airlines profits and the various parameters including, research and development, brand name and product development. The results as in the table 4.23 below show that none of the factors research and development, brand name and product development, has a relationship with the airlines profitability. All the respective P-Values of 0.024, 0.831 and 0.172 for research and development, brand name and product development respectively, are above alpha (0.05), at 95% Confidence interval. This shows that the airlines profit levels are affected by any of them, either research and development, brand name and product development

Table 4.23: Innovation and knowledge Probit Variance Explained

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>Z</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBIT*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research development</td>
<td>-.419</td>
<td>.186</td>
<td>-2.256</td>
<td>.024</td>
<td>-.784</td>
<td>-.055</td>
<td>.648</td>
</tr>
<tr>
<td>RD profits</td>
<td>.175</td>
<td>.242</td>
<td>.723</td>
<td>.469</td>
<td>.299</td>
<td>.648</td>
<td></td>
</tr>
<tr>
<td>Effective brand name</td>
<td>.082</td>
<td>.385</td>
<td>.213</td>
<td>.831</td>
<td>-.673</td>
<td>.838</td>
<td></td>
</tr>
<tr>
<td>Brand name profits</td>
<td>-.525</td>
<td>.767</td>
<td>-6.84</td>
<td>.494</td>
<td>-.202</td>
<td>.979</td>
<td></td>
</tr>
<tr>
<td>Product development</td>
<td>1.024</td>
<td>.750</td>
<td>1.365</td>
<td>.172</td>
<td>.446</td>
<td>2.494</td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td>-.156</td>
<td>.186</td>
<td>-.841</td>
<td>.400</td>
<td>-.520</td>
<td>.208</td>
<td></td>
</tr>
<tr>
<td>Effective brand profits</td>
<td>-.060</td>
<td>.182</td>
<td>-.330</td>
<td>.742</td>
<td>-.418</td>
<td>.297</td>
<td></td>
</tr>
<tr>
<td>Interceptb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>.617</td>
<td>.360</td>
<td>1.711</td>
<td>.087</td>
<td>.256</td>
<td>.977</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>.875</td>
<td>.335</td>
<td>2.611</td>
<td>.009</td>
<td>.540</td>
<td>1.210</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>.956</td>
<td>.403</td>
<td>2.371</td>
<td>.018</td>
<td>.553</td>
<td>1.359</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>.544</td>
<td>.458</td>
<td>1.186</td>
<td>.236</td>
<td>.085</td>
<td>1.002</td>
<td></td>
</tr>
</tbody>
</table>

a. PROBIT model: PROBIT (p) = Intercept + BX (Covariates X are transformed using the base 2.718 logarithm.)

b. Corresponds to the grouping variable Profits_other_airlines.

The findings of this study reveal that most airlines companies do not undertake research and development function to boost their product and services unlike this is suggestive that innovation has not resulted to increased airline profits unlike from other studies such as Diederden et al. (2002) conclude that innovative farmers show significantly higher profits and growth figures than firms that are not innovative. Also Favre et al. (2002) conclude there is a positive impact of innovations on profits. They take R&D intensity, market share, and concentration as the relevant causal factors. Also national R&D spillovers and, moreover, international R&D spillovers are positive for profits. Avanitis and Hollerstein (2002) conclude that the use of external knowledge, technological opportunity and the degree of innovativeness significantly increase the productivity

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of knowledge capital. The deliberate pursuit of certain objectives (e.g. creating a new market) and higher appropriability conditions raise the return to patents.

The study by Loof (2000) showed a positive relationship of innovative sales per employee (elasticity) on five different performance measurements (employment growth, value added per employee, sales per employee, operating profit per employee, and return on assets). Meinen (2001) is positive on the question whether innovation is worth doing. He noted that Firms executing R&D on a permanent basis, that co-operate with others and use various sources of information realise extra turnover of one percent point over 1996-1998.

VI. CONCLUSION

The purpose of the objective was to identify whether Innovation and Knowledge had an effect on profitability of Kenyan airlines in the aviation industry. The findings revealed that most airlines do not engage in product creation and development. This is because according to the respondents most airlines do not have an internal and mechanism to conduct research as a result there is no progress in creativity that initiates novel ideas to airlines for successful operation, attraction of passengers that in turn would lead to increased profitability. The presence of airlines brand name availability does not generate immediate profit to the organization. This is because the absence of strong brand name in the market results to lower visibility to the potential passengers who may end up choosing to use the service of only one dominant carrier. This lack of effective brand name from lack of marketing results to lower profitability to the airlines. The Probit regression and correlation results indicated that there was a positive and significant relationship between innovation knowledge and profitability of airlines in aviation industry. The findings imply that innovation and knowledge were statistically significant in explaining the profitability of airlines in aviation industry.

REFERENCES


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Management Credit risk assessments and financial analysis

Mohamed Omar Sharif Phd.,Candidate
KhamisMiladALdziri

Abstract: Modern business environment is always affected by some sort of changes. These changes are unpredictable, volatile, and more complex every day. It is connected to various kinds of risks. To ensure successful business performance risks are should be minimized or mitigate always at the lowest possible level.

The increased demand for transparency around risk has not always been provided and the poor quality of underlying assets significantly impacted the value of investments. In the current global economic environment, identifying, managing, and exploiting risk across an organization has become increasingly important to the success and sustainability of any business.

Today, banking regulators are demanding a shift from a credit review process contingent on the opinions of individuals to a systematic process based on objective inputs and understood internal rating models that best predict default events. This change, primarily driven by the need for more accurate, timely risk assessments, is critically dependent on standardized financial and non-financial risk inputs. At the same time, regulators are requiring banks to document the inputs and outputs of their internal ratings processes. The challenge of bringing this data together is further complicated by the fact that bank portfolios are diverse, operating across many different credit types and geographies.

The goal of the study is to explain the model for management credit assessment, and to show what conditions on the project should be fulfilled for credit approval.

Methodology approach to this research is the data collected from many previous studies, which are coming by the quantitative method, because of many considers of analysis process as: concerned with hypothesis testing, uses large sample, data is highly specific, reliability is high. This project intends to make use of both qualitative and quantitative tools of investigation. By adopting an action research platform allied with a case study approach which incorporates the participants into the research process it is hoped that an effective and workable solution to these problems can be devised.

Hypothesis 1: Management the credit risk assessment will highly influence the bank decision for credit approval to the project.

Collecting and analysis of credit data

To collect necessary data for credit assessment it is requisite to obtain a comprehensive view of each customer across a wide-range of assets including company financials, real estate holdings, borrower financials and other pertinent data to one place. Financial templates and tools are recommended for minimizing errors in data entry. Also it is advisable to standardize way of spanning financial data.

The way of storing the data is very important, to avoid data loss and redundancy. Single source for all data considering credit decision process is saving time for managers, audit, and all inquires.
For better decision making about lending, saving time and reduce complexity it is recommendable to use standardized credit risk scorecards which outline rating decisions. It has to be made structured risk management framework for easier evaluation and perform scenario analysis. Reports should be clear and understandable for analysts and senior management.

The importance of accounting standards and reporting standards

The process of preparing financial reports of transparency and integrity are more than just the application of accounting standards, which aims to provide consistency and comparability, and increase the possibility that members of boards of directors represent the interests of shareholders and owners of the company. Whereas countries all over the world still continue its efforts to develop economies, there is increased importance of following accounting standards and reporting standards of financial systems. Without these standards there is less ability of companies to attract various funds, due to the inability investors to evaluate the risks and rewards associated with these investments. Risk assessment as a job is not easy.

Proper standards of accounting and reporting helps to support accounting employability for responsibility, integrity and transparency, they also encourage the optimal use of resources, and working to attract capital more interest rates reasonable, as well as it supports their ability to organize projects and create new jobs, and help significantly on economic growth and the progress of democracy and economic reform. The proper accounting standards support efficient financial management, saluting the proper system of reporting is that provides vital information to creditors and equity investors, so as to create them to make investments safe and profitable.¹

The making a choice of accounting standards is a matter for the state alone. However, companies that use accounting standards and reporting standards are not acceptable, and widely in the global capital markets will face higher transaction costs in access to capital and funding of these markets. Security problems may lead to capital development of private accountants to prepare financial reports so that they are better accepted by the investors. In this field have been achieved significant progress in the development of a set of international standards that can provide following instant credibility to a large part of the financial reporting system in any country.

The high quality of the financial reports depends on infrastructure assistance that works to ensure that the interpretation, translation and application of those standards in a precise way, and to identify issues and solve problems quickly, and include infrastructure:

- the presence of high quality standards for the audit process
- necessity of a professional companies specialized and independent audit with the development of effective national control of quality
- necessity of meet the requirements of quality control of all aspects of the audit profession
- necessity of supervision of the Securities and Exchange Commission on accounting standard mode
- necessity of supervision of the Securities and Exchange Commission on the operations of translation, interpretation and application of the standard through a process of review and comment by the corporate finance department to contribute.²

Appropriate standards of information

The accounting information must be characterized by appropriate feature, so as to increase its influence in the control the present and the internalization of the past to predict the future objectively make it easier for users to process that information and decision-making more accurate and highly efficient.

As if that information was inappropriate, but in order to achieve the appropriate recipe for that information must be provided with the following specific characteristics:

- Predictive capacity: information must be characterized by their ability to predict the future and increase confidence, so as to avoid potential losses and to increase the accuracy of the reserves to be configured for the future to meet the potential decrease in assets or increase liabilities, or both of them

- The possibility to validate expectations: requires user accounting information be able to take advantage of cryptographic ability to validate past expectations on the one hand, and guided the prediction of regarding future prospects on the other hand, this helps the decision maker in the correct expectations, especially when preparing budgets and specifically cash budget for both sides of the payments and receipts because the capacity of the information in the correct expectations assist in the implementation of budgets for the various activities.

- The appropriate timeliness: one of the most important characteristics of accounting information to provide to its users in a timely manner to take advantage of them to take appropriate decisions to address the imbalance and deficiencies in a timely manner, with less effort and the lowest level of costs and losses.

- Trust in information: to be the accounting information that has enough to rely on and trust in, this requires attention to the principle of disclosure, objectivity and impartiality of that information to reassure decision makers of confidence in this information, as reflecting a true reflection of real financial position of the Corporation and represent the results of our work are the best representation.

- Accounting information to be presented is useful for users to be available properties listed and also to achieve this requires that the professional organizations follow the method depends on the participation of all interested parties the criteria and instructions from professionals and users, academics.3

The role of accounting information in performance assessment

To evaluate the performance different definitions of the performance appraisal system is which you can stand at the level of efficiency of the actual performance of all activities and put in front of those responsible for the management of the unit detailed picture of the results of this performance and detection abreast of decisions to treat the negatives and correct course of action in order to enhance performance and increase productivity.

The accounting information has essential role in the performance appraisal system. The performance of any organization cannot be done only through the availability of information with high quality specify how or value achievement to be achieved, and the information one of the pillars in the processes control and performance assessment and decision-making from the user's perspective the internal and external, where the outputs of the performance appraisal process and constitute control inputs to the decision-making processes both internally and externally and be useful and positive decisions if adopted on high-quality information, good a decision requires accurate and good information.

3 http://www.isaca.org
Through the difference of definitions prior to the accounting information systems, it a group of components or elements of human and machine working together within the organization, according to the procedures and specific rules for compile and run data on financial transactions and non-financial in order to provide information that management of the organization in planning and control, as well as external parties in make appropriate economic decision.

**Risk assessment**

Risk assessment provides help to find out mechanism for identifying which risks represent potential opportunities and which could be pitfalls. Risk assessment gives organizations a clear view of variables to which they may be exposed, whether internal or external. Risk assessment process, helps management to better identify, evaluate, and exploit the right risks for their business, while maintaining the appropriate controls to ensure effective and efficient operations.

For risk assessments to yield meaningful results, certain key principles must be considered. A risk assessment should begin and end with specific business objectives that are anchored in key value drivers. These objectives provide the basis for measuring the impact and probability of risk ratings.

Risk assessment is a systematic process for identifying and evaluating events (i.e., possible risks and opportunities) that could affect the achievement of objectives, positively or negatively. Such events can be identified in the external environment (e.g., economic trends, regulatory landscape, and competition) and within an organization’s internal environment (e.g., people, process, and infrastructure).

While organizations have been conducting risk assessments for years, many still find it challenging to extract their real value. The linkage of risk assessment to drivers of shareholder value and key objectives has sometimes been lost. Risk assessments can be mandated by regulatory demands (Basel II) and focus on such processes as monitoring of client accounts, operational risk management, and internal control over financial reporting. Risk assessments can also be driven by an organization’s own goals, such as business development, talent retention, and operational efficiency. Regardless of the scope or mandate, risk assessments must bring together the right parties to identify events that could affect the organization’s ability to achieve its objectives, rate these risks, and determine adequate risk responses.

**Risk analysis**

Risk analysis in a broad sense is the act of identifying and analyzing risk factors and finding it root cause. Risk analysis on the other hand consists of: identification of hazard in an organization. Risk analysis can be divided into two broad methods; these methods can be qualitative and quantitative. The qualitative risk analysis method is made for improving an organizations attention toward potential problems and this can be assist through analyzing this type of risk. However, quantitative risk analysis is made so that assurance can be implemented and so that it can be allowed to develop cost which can be implemented as well. This quantitative risk analysis is the simplest one to use and more often than not many organizations use it.

Qualitative risk analysis is very beneficial because it can help companies to identify lots of hidden risk as well as valuable resources which are sensitive to these risks. Qualitative risk analysis does not only provide safety measures to be implemented but also

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provide to those that could be effective if they are implemented. It is the main aim of the qualitative risk analysis to gain a level which can protect risk in pleasant ways and one which can improve upon the awareness among most of the organizations.

The base of this analysis is often calculation bases and it is not very important to know the value or assets involve. The quantitative risk analysis more or less does the same things does by qualitative risk analysis, it is also able to easily identify cases which are safeguarded. Quantitative is base highly instinctive which uses metrics that requires a higher level of effect provided to it. Risk analysis requires identification and documentation of all risks. Having identified each of the risk activities relevant to practice, there is a need to list them in order of severity and frequency. This is a difficult process as one risk activity may carry a high severity factor but the likelihood of something going wrong may be remote.

Risk analysis results and management plans should be updated periodically. There are two primary reasons for this:

- to evaluate whether the previously selected security controls are still applicable and effective
- to evaluate the possible risk level changes in the business environment. For example, information risks are a good example of rapidly changing business environment.6

**Basel principles**

The Basel Committee on Banking Supervision (BCBS) is a committee of banking supervisory authorities that was established by the central bank governors of the Group of Ten countries in 1974. It provides a forum for regular cooperation on banking supervisory matters. Its objective is to enhance understanding of key supervisory issues and improve the quality of banking supervision worldwide. The committee also frames guidelines and standards in different areas, among them, are the international standards on capital adequacy, the Core Principles for Effective Banking Supervision and the Principles for the Management of Credit Risk.

The Basel Committee recognizes that each bank’s specific disclosures will vary in scope and content according to its level and type of activities. Therefore, it may not be necessary for a bank to provide all the disclosures discussed in the paper, if particular information is not material for an external assessment of the bank. Nevertheless, all banks are expected to provide sufficient, timely, and detailed information that allows market participants to make meaningful assessments of the bank’s credit risk profile. Apart from providing best practices for credit risk disclosure, the paper also discusses related supervisory information needs and the types of information supervisors collect on credit risk.

Basel II, initially published in June 2004, was intended to create an international standard for banking regulators to control how much capital that banks need to put aside to guard against the types of financial and operational risks that banks (and the whole economy) face. Basel II Framework is based on a forward-looking approach that enables improvements and adjustments of time to time. This is to ensure that the Basel II framework may follow changes in the market and developments in management risk. The Basel II calculate capital requirements in accordance with the bank's risk profile, as well as providing incentives for improvement in 6 Chapman, C, Ward., S, (2007), Project Risk Management: Processes, Techniques and Insights, John Wiley & Sons
the quality of risk management practices in banking. By using a variety of alternative approaches (approaches) to measure credit risk (credit risk), market risk (market risk) and operational risk (operational risk), then the result is the calculation of bank capital which is more sensitive to risk (risk sensitive capital allocation).

In Basel II, bank capital calculations are contained in Pillar 1 -Minimum Capital Requirement. Various alternative approaches basically can be grouped into two major groups, namely the standard approach applied to all banks (standardized models) and the model of developed internal business activities in accordance with the characteristics and risk profiles of individual banks (internal models) making it more sophisticated. In the Principles for the Management of Credit Risk published in July 1999, the Principle 10 also stated that bank should develop and utilize internal risk rating systems in managing credit risk. The rating system should be consistent with the nature, size and complexity of a bank’s activities.

Internal risk ratings are an important tool in monitoring and controlling credit risk. With the use of internal rating system, it will allow more accurate determination of the overall characteristics of the credit portfolio, concentrations, credits problem, and the adequacy of loan loss reserves. Internal risk rating system categorizes credits into various classes ranging from satisfactory to unsatisfactory designed to take into account the gradations in risk.

The Basel Committee has identified the following five broad areas in which banks should provide comprehensive and accurate disclosures:

- Accounting policies and practices;
- Credit risk management;
- Credit exposures;
- Credit quality;
- Earnings.

**Bank loans**

Modern economies depend on credit to finance all forms of activity, from large commercial credits to retail credit such as mortgages and credit cards. Managing credit and understanding associated risks are as important to consumers as they are to bankers and investors. Commercial banks have a great influence on the growth of a nation's economy. The profitability of commercial banks is largely attributed to the interest charged on loans they advance to their customers. If these loans are defaulted, banks face the risk of collapsing and the entire economy will be threatened. Banks use credit derivatives to protect themselves against credit risk arising from loan defaulters. Loan defaulting has been and continues to be a cause of financial distress in the banking sector locally as well as globally. ⁷

There are many reasons for giving and taking loans. The bank should have a detailed understanding of a loan’s purpose in order to assess risk and be able to structure financing to the benefit of both the client and the bank. Loans that have a legitimate purpose in accordance with the policies of the bank serve to provide liquidity to the economy and financial support to the commercial and industrial sectors in support of economic growth. ⁸

Main reasons for bank’s loans:

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• Support or expand the productive capacity of businesses
• Utilize domestic inputs and suppliers which help forge strong integration of the economy
• Create the potential for exports and the development of foreign exchange
• Support private sector development
• Support the development and growth of individual firms
• Maximize the opportunity for employment growth
• Reduce import dependency

**Evaluation of credit risk**

Within the regulatory restrictions bank determines future borrowers, loan types, forms the loan portfolio and sets interest rates. In forming the bank's loan portfolio follows the general principles for investors: a combination of high-and fairly risky investments with less profitable but less risky, and areas of lending. An important component of credit and investment strategy of the bank is the interest strategy. Demand for credit is related to the ability of investors to invest in the real economy, with a level of profitability of other ways of investment (investments in foreign currency, securities), the purpose and conditions of the loan, the degree of risk.

If a positive decision on granting a loan agreement is signed. Pre-agreed amount of credit can be further adjusted by the parties. In case of early repayment or partial use of his bank by the borrower loses a part of interest income. Credit portfolio is under constant control of the bank. Payments of interest the bank loses income, with non-return of principal bank writes off bad loans at cost and has a loss on the loan agreement. To determine the amount of credit risk the probability of its occurrence based on statistical data are calculated possible outcome of the credit transaction. Given the known distribution of the results of the credit agreement, determined by the expected return and standard deviation of the mean income and projected its sum.

Ways to minimize credit risk is to diversify the loan portfolio, a preliminary analysis of the creditworthiness and solvency of the borrower, the application of methods to ensure repayment of the loan (for example, collateral, guarantees) the formation of reserves to cover possible losses on loans. Credit risk mitigation is one of the tasks of the bank credit portfolio management. Methods of assessing credit risk are determined by the relevant standards.

Credit risk can be predicted on the basis of the method "liquidation period", according to which the loan or lending model driven by a specific time interval and coincides with the maturity of the debt obligation, or with the time needed for final payment on it. In the event the borrower defaults credit losses are the difference between the potential losses in default on a loan (the amount owed at the time of default) and the present value of future net consideration (payment the borrower minus the cost of providing compensation).

Methodology of credit and investment bank's strategy includes definitions of basic principles.
• The first principle is determined by the need of effective governance of banks in the context of globalization, high financial risks and uncertainty.
• The second principle is the need to adapt international experience to the domestic banking system, the specificity of which is to "chronic" crisis of the financial system, the formation of the banking sector in a fragile state of the industry and the drop in production.
Credit and lending operations are directly related and necessary to analyze the factors that determine the impact of the credit strategy of the bank. The basic principles of lending are the repayment, maturity, payment, security, targeted. It does not matter if the bank or the client acts as a lender. Credit components of the strategy are: the general rules for granting loans, loan classification, specific areas of credit strategy, quality control, credit committees. Banking power is measured by total funds available to the credit institution (intangible assets). This can be: skilled personnel loan officers; best forms and methods of credit, lending and investing experience, information technology in the field of lending.

Bank lending volumes are funds that the bank plans to invest in lending operations. In the development of credit and investment strategies of banks is the main task of understanding the global trends of social development and their role in this development. Mission -this is what the bank called and can carry over the entire period of its existence on the chosen path of activity; is what ultimately determines the bank's activities and distinguishes it from other financial institutions.

The basis of banking strategy is to predict the best alternatives for its development, the main factors of influence on the development strategy are uncertain, and profitability. Another factor in the credit and investment bank's strategy is to manage the interest rate mechanism. It needs to especially pay attention to inflation risk, which is divided on expected inflation risk and the risk of unexpected inflation (interest rate risk). It is therefore proposed to review the structure of interest rates using a linear model that takes into account the different types of risks through appropriate indices.

As part of the evaluation process, credit management also calls for determining the total credit line that will be extended to a given customer. Several factors are used as part of the credit management process to evaluate and qualify a customer for the receipt of some form of commercial credit. This includes gathering data on the potential customers’ current financial condition, including the current credit score. The current ratio between income and outstanding financial obligations will also be taken into consideration.

It is well known that an inaccurate estimation of risk parameters leads to a loss of income that may arise from a lender and credited. In this case one party gains additional revenue equal to the sum of foregone profit partner of the credit transaction. Since the bank is always in a situation of a creditor (credit market) and credited (in the deposit market), the correct assignment rate of interest is a prerequisite for loss-free activity.

The revaluation process is complicated by the credit risk of loan default, which reduces the profitability of the bank. Bank deposit market is the subject of credit. The situation shows a mirror: the underestimation of a factor in the deposit rate the bank receives income and the revaluation—a loss. Based on assessment of the factors lending, we can conclude that the underestimation of the value of inflation in the credit interest rate, like the re-evaluation of its deposit rate to negatively affect the bank's activities.

A bank shall regularly analyze the structure and quality of its credit portfolio, including the assessment of concentration risk and residual risk, as well as assessment of future changes of this portfolio. The evaluation of credit rating continues to be an imprecise process. Over time, this approach needs to be standardized across institutions and across borrowers. In addition, its rating procedures need to be made compatible with rating systems elsewhere in the capital market. Credit losses, currently vaguely related to credit rating, need to be closely tracked. As in the bond market, credit pricing, credit rating and expected loss ought to be demonstrably closer. However, the industry currently does not have a sufficiently broad data base on which to perform the migration analysis that has been studied in the bond market.

The issue of optimal credit portfolio structure warrants further study. In short, analysis is needed to evaluate the diversification gains associated with careful portfolio design. At this time, banks appear to be too concentrated in idiosyncratic areas, and not sufficiently managing their credit concentrations by either industrial or geographic areas. Competent credit management seeks to not only protect the vendor from possible losses, but also protect the customer from creating more debt obligations that cannot be settled in a timely manner. Loans have become increasingly packaged for resale, meaning that an investor buys the loan (debt) from a bank or directly from a corporation. Bonds are debt instruments sold to investors for organizations such as companies, governments or
charities. The investor can then hold the debt and collect the interest or sell the debt on a secondary market. Banks are the main facilitators of funding through the provision of credit, although private equity, mutual funds, hedge funds, and other organizations have become important as they invest in various forms of debt. Financial assets, known as investments, are financially managed with careful attention to financial risk management to control financial risk. Financial instruments allow many forms of securitized assets to be traded on securities exchanges such as stock exchanges, including debt such as bonds as well as equity in publicly traded corporations.

Credit management analysis is the process of determining the operating and financial characteristics of the firm from accounting data, profit and loss account and balance sheet. The goal of rush analysis is to determine the efficiency and performance of the firms’ management as reflected in the financial records and reports. The financial analysis is a starting point for making plans before using any sophisticated, forecasting and planning procedure. Hence the main objective of financial analysis is to make a detailed study about the cause and effect of the profitability and financial condition of the firm.

Financial statements generally refer to four basic statements the income statements, the balance sheet, the statement of retained earnings and the sources and uses of funds statements. The financial statements, taken together, give the accounting picture of the firm's operations and financial position. Sound financial health of a bank is the guarantee not only to its depositors but is equally significant for the shareholders, employees and whole economy as well. As a sequel to this maxim, efforts have been made from time to time, to measure the financial position of each bank and manage it efficiently and effectively.

Financial performance analyses assess the banks’ profitability, solvency, liquidity and stability. Profitability is its ability to earn income and sustain growth in both short-term and long-term. A company's degree of profitability is usually based on the income statement. Solvency is its ability to pay its obligation to creditors and third parties in the long term. Liquidity is its ability to maintain positive cash flow, while satisfying immediate obligations. Stability is the firm's ability to remain in business in the long run, without having to sustain significant losses in the conduct of its business. Assessing a company's stability requires the use of both the income statement and the balance sheet.

**Assessment of credit risk management**

The independent risk management assessment function shall ensure that the credit granting function is being properly managed and that credit exposures are consistent with official standards and the internal limits of the supervised entity that the management information systems provide correct and adequate data on the supervised entity's aggregate credit exposures and changes in these over time that internal controls have been designed in such a way that exceptions to policies, procedures and limits are reported in a timely manner to the appropriate level of management for action that the supervised entity has adopted procedures for changing over to more frequent customer monitoring in case of impaired payment capacity as well as procedures for managing problem credits. The independent risk management assessment function shall report directly to the board of directors and senior management.

Assessing credit risk requires us to model the probability of a counterparty defaulting in full, or in part, on its obligation. We can picture the credit decision in terms of the basic risk management model. This involves a decision either

- to extend credit, which provides a reward but entails a risk,
- or to refuse credit.

The requirement is to balance the gain from taking the credit risk by extending credit against the potential loss. In the decision problem the alternative is to refuse credit and not obtain any reward. The credit risk decision facing a firm relates to

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• the gain if no default happens against

• the potential loss from extending credit based on the likelihood that default takes place and the amount that is lost if default occurs.

There are only two possible outcomes: the credit performs according to expectations or the credit defaults. If the credit defaults the cost to the credit manager will be the cost or the replacement value for what has not been provided.

For instance, in deciding whether to provide trade credit a firm faces a decision as to which applications to proceed with; what limit to set on the amount of credit extended and whether this needs to be modified over time; what action should be taken if there is a delay in repayment; and, which counterparties should be actively solicited for business.

Although the nature of the credit analysis decision can be readily described, the steps required to effectively manage the process are more complicated. In essence, the problem relates to the risk that counterparties will not honor their obligations when the moment comes for them to perform under their contract. Determining which counterparty may default is the art of credit risk management. Different approaches use judgment, deterministic, or relationship models, or make use of statistical modeling in order to classify credit quality and predict likely default frequency.

**Financing the large scale project**

Project finance is a term used to describe the financing of any large capital investment that involves a longer time horizon with long run benefits. A significant part of project finance is arranged through credit. Usually projects are funded through a mix of debt and equity because it is nearly impossible for the promoters to raise sufficient equity for large projects. Project finance is different from other types of financing. Project financing is mainly of two types: non-recourse and limited recourse. A financial appraisal of any project finance has three main stages — cash flow forecasts, estimation of the economic worth of the project, and assessing the creditworthiness of the project. The project credit risk mitigants differ depending upon the project in hand in an ideal situation all risks arising from the project study should be covered.⁹

Projects like power plants, toll roads or airports share a number of characteristics that make their financing particularly challenging.

• First, they require large indivisible investments in a single-purpose asset. In most industrial sectors where project finance is used, such as oil and gas and petrochemicals, over 50% of the total value of projects consists of investments exceeding $1 billion.

• Second, projects usually undergo two main phases (construction and operation) characterized by quite different risks and cash flow patterns. Most of the capital expenditures are concentrated in the initial construction phase, with revenues instead starting to accrue only after the project has begun operation.

• Third, the success of large projects depends on the joint effort of several related parties so that coordination failures, conflicts of interest and free-riding of any project participant can have significant costs. Moreover, managers have

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substantial discretion in allocating the usually large free cash flows generated by the project operation, which can potentially lead to opportunistic behavior and inefficient investments.\textsuperscript{10}

**Constructing the project cost model**

The project cost model includes all capital and operating costs associated with the project and also includes a costing for all the risks associated with the project.

**Key characteristics of the project cost model**

- Expressed as the net present value (NPV) of a projected cash flow based on an appropriate discount rate for the public sector
- Based on the costs for the most recent, similar, public sector project, or a best estimate
- Costs expressed as nominal costs
- Depreciation not included, as it is a cash-flow model.

**Step 1: Provide a technical definition of the project**

What norms and standards will be applied in the project? What maintenance cycles are expected?

**Step 2: Calculate direct costs**

Direct costs are those that can be allocated to a particular service. These costs must be based on the most recent public sector project to deliver similar infrastructure or services (including any foreseeable efficiencies, for example regular life-cycle maintenance), or a best estimate where there is no recent comparable public sector project.

- Capital costs-Direct capital costs are specifically associated with the delivery of new services, including, but not limited to, the costs of design, land and development, raw materials, construction, and plant and equipment (including IT infrastructure). Direct capital costs should also account for the projects’ labor, management and training costs, including financial, legal, procurement, technical and project management services. It is also important to include the costs of replacing assets over time.
- Maintenance costs-Direct maintenance costs will include the costs over the full project cycle of maintaining the assets in the condition required to deliver the specified outputs, and may include the costs of raw materials, tools and equipment, and labor associated with maintenance. The level of maintenance assumed must be consistent with the capital costs and the operating cost forecasts.
- Operating costs-Direct operating costs are associated with the daily functioning of the service and will include full costs of staff (including wages and salaries, employee benefits, accruing pension liabilities, contributions to insurance, training and development, annual leave, travel and any expected redundancy costs), raw materials and consumables, direct management and insurance.

**Step 3: Identify indirect costs**

The project’s indirect costs are a portion of the institution’s overhead costs, and will include the costs of: senior management’s time and effort, personnel, accounting, billing, legal services, rent, communications and other institutional resources used by the project. The portion can be determined by using an appropriate method of allocation, including but not limited to:


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number of project employees to total institutional employees for personnel costs
- project costs to total institutional costs for accounting costs
- number of project customers to total institutional customers for billing costs.

**Step 4: Identify any revenue**
The total cost of delivering the service should be offset by any revenues that may be collected.
Project revenue may be generated where:
- users pay for the service or a part thereof
- the use of the institution’s assets generates revenue
- service capacity exists above the institution’s requirement
- the institution allows third parties to use the service.

Any revenue collected must reflect the institution’s ability to invoice and collect revenue.

**Step 5: Explain assumptions**
Explain in detail all assumptions the model makes about the inflation rate, the discount rate, depreciation, treatment of assets, available budget(s), and the government’s Medium-Term Expenditure Framework (MTEF).

- Inflation-The model should be developed using nominal values. In other words, all costs should be expressed with the effects of expected future inflation included. Nominal figures reflect the true nature of costs, as not all costs are inflated at the same rates. This also allows for easy comparison with the institution’s budget, which is expressed using nominal values.
- The discount rate-For practical purposes the discount rate is assumed to be the same as the risk-adjusted cost of capital to government.
- Depreciation-Since the PROJECT FINANCIAL MODEL is calculated on cash flow, not on accrual, non-cash items such as depreciation should not be included.

**Project financial model**

In conventional public sector procurement, risk is the potential for additional costs above the project cost model. Historically, conventional public sector procurement has tended not to take risk into account adequately. Budgets for major procurement projects have been prone to optimism bias – a tendency to budget for the best possible (often lowest cost) outcome rather than the most likely. This has led to frequent cost overruns. Optimism bias has also meant that inaccurate prices have been used to assess options. Using biased price information early in the budget process can result in real economic costs resulting from an inefficient allocation of resources.

Much of the public sector does not use commercial insurers, nor does it self-insure (through a captive insurance company). Commercial insurance would not provide value for money for government, because the size and range of its business is so large that it does not need to spread its risk, and the value of claims is unlikely to exceed its premium payments. However, government still bears the costs arising from uninsured risks and there are many examples of projects where the public sector has been poor at managing insurable (but uninsured) risk.

**Step 1: Identify the risks**
Explore each risk category in detail. It is important to identify and evaluate all material risks. Even if a risk is unquantifiable, it should be included in the list. When identifying risks by referring to an established list, there is the possibility that in the list
generated for the project, a risk not listed may have been left out by mistake (as opposed to simply not being a risk for this specific project).

It may be difficult to compile a comprehensive and accurate list of all the types of risks. The following can be helpful sources of information:

- similar projects (information can be gathered from the original bid documents, risk matrices, audits and project evaluation reports)
- specialist advisors with particular expertise in particular sectors or disciplines.

**Step 2: Identify the impacts of each risk**

The impacts of a risk may be influenced by:

- **Effect:** If a risk occurs, its effect on the project may result, for example, in an increase in costs, a reduction in revenues, or in a delay, which in turn may also have cost implications. The severity of the effect of the risk also plays a role in the financial impact.
- **Timing:** Different risks may affect the project at different times in the life of the project. For example, construction risk will generally affect the project in the early stages. The effect of inflation must also be borne in mind.

It is essential to specify all the direct impacts for each category of risk. For example, construction risk is a broad risk category, but there could be four direct impacts, or sub-risks:

- cost of raw material is higher than assumed
- cost of labor is higher than assumed
- delay in construction results in increased construction costs
- delay in construction results in increased costs as an interim solution needs to be found while construction is not complete.

**Step 3: Estimate the likelihood of the risks occurring**

Estimating probabilities is not an exact science, and assumptions have to be made. Ensure that assumptions are reasonable and fully documented, as they may be open to being challenged in the procurement process or be subject to an audit. There are some risks whose probability is low, but the risk cannot be dismissed as negligible because the impact will be high (for example, the collapse of a bridge). In this case a small change in the assumed probability can have a major effect on the expected value of the risks. If there is doubt about making meaningful estimates of probability, it is best practice to itemize the risk using a subjective estimate of probability rather than to ignore it. Institutions should also be prepared to revisit initial estimates, if they learn something new that affects the initial estimate. Together with estimating the probability of a risk occurring, it is also necessary to estimate whether the probability is likely to change over the term of the project.

**Step 4: Estimate the cost of each risk**

- Estimate the cost of each sub-risk individually by multiplying the cost and the likelihood.
- Assess the timing of each sub-risk.
- Cost the sub-risk for each period of the project term.
- Construct a nominal cash flow for each risk to arrive at its net present value.

**Step 5: Identify strategies for mitigating the risks**

A risk can be mitigated either by changing the circumstance under which the risk can occur or by providing insurance for it. Indicate what the risk mitigation strategy for dealing with each particular risk will be, and the attendant cost of such mitigation. This is the most important part of the risk assessment and should identify specific steps taken or to be taken to mitigate risks.

**Step 6: Construct the risk-adjusted project cost model**

Once costs have been established for all identified risks, the base project cost model must be risk-adjusted. This is done using the following simple formula:
Risk-adjusted cost = Base cost + Risk

Step 7: Preliminary analysis to test affordability

As a preliminary assessment of the project’s affordability, compare the risk-adjusted project cost model with the institution’s budget for the project as estimated during the solution options analysis. If the project looks unaffordable by a wide margin, it may be necessary to revisit the options analysis.

Conclusion

A cost-benefit analysis is a common type of business decision-making tool that involves quantitative reasoning. In a cost benefit analysis, managers decide the best course of action out of two or more possible courses of action by attributing values to the expected benefits of different courses of action and comparing those values. For example, if a company is trying to decide whether to spend its money on launching a new product or spending more toward advertising current products, it might conduct a cost-benefit analysis to estimate how much profit it could expect from each course of action and then choose the course that is expected to produce more profit.

A cost benefit analysis is used to evaluate the total anticipated cost of a project compared to the total expected benefits in order to determine whether the proposed implementation is worthwhile for a company or project team. If the results of this comparative evaluation method suggest that the overall benefits associated with a proposed action outweigh the incurred costs, then a business or project manager will most likely choose to follow through with the implementation.

Generally speaking, a cost-benefit analysis has three parts. First, all potential costs that will be incurred by implementing a proposed action must be identified. Second, one must record all anticipated benefits associated with the potential action. And finally, subtract all identified costs from the expected benefits to determine whether the positive benefits outweigh the negative costs.

- **Identifying Costs** The first step is to identify and quantify all costs associated with a proposed action. In order to successfully identify all potential costs of a project, one must follow the subsequent steps.
  - Make a list of all monetary costs that will be incurred upon implementation and throughout the life of the project. These include start-up fees, licenses, production materials, payroll expenses, user acceptance processes, training, and travel expenses, among others.
  - Make a list of all non-monetary costs that are likely to be absorbed. These include time, lost production on other tasks, imperfect processes, potential risks, market saturation or penetration uncertainties, and influences on one’s reputation.
  - Assign monetary values to the costs identified in steps one and two. To ensure equality across time, monetary values are stated in present value terms. If realistic cost values cannot be readily evaluated, consult with market trends and industry surveys for comparable implementation costs in similar businesses.
  - Add all anticipated costs together to get a total costs value.
• **Identifying Benefits** The next step is to identify and quantify all benefits anticipated as a result of successful implementation of the proposed action. To do so, complete the following steps.
  
  ✓ Make a list of all monetary benefits that will be experienced upon implementation and thereafter. These benefits include direct profits from products and/or services, increased contributions from investors, decreased production costs due to improved and standardized processes, and increased production capabilities, among others.
  
  ✓ Make a list of all non-monetary benefit that one is likely to experience. These include decreased production times, increased reliability and durability, greater customer base, greater market saturation, greater customer satisfaction, and improved company or project reputation, among others.
  
  ✓ Assign monetary values to the benefits identified in steps one and two. Be sure to state these monetary values in present value terms as well.
  
  ✓ Add all anticipated benefits together to get a total benefits value.

• **Evaluate Costs and Benefits** The final step when creating a cost benefit analysis is to weigh the costs and benefits to determine if the proposed action is worthwhile. To properly do so, follow the subsequent steps.
  
  ✓ Compare the total costs and total benefits values. If the total costs are much greater than the total benefits, one can conclude that the project is not a worthwhile investment of company time and resources.
  
  ✓ If total costs and total benefits are roughly equal to one another, it is best to reevaluate the costs and benefits identified and revise the cost benefit analysis. Often times, items are missed or incorrectly quantified, which are common errors in a cost benefit analysis.
  
  ✓ If the total benefits are much greater than the total costs, one can conclude that the proposed action is potentially a worthwhile investment and should be further evaluated as a realistic opportunity.

**Literature**

• Basel Committee on Banking Supervision, Sound credit risk assessment and valuation for loans, Basel, 2006
• Brown, K, Moles, P., Credit Risk Credit Risk Management, Edinburgh Business School, Edinburgh, 2012
• Basel Committee on Banking Supervision (BCBS), An Assessment of the Long-Term Economic Impact of Stronger Capital and Liquidity Requirements, 2010

www.ijsrp.org

• Basel Committee on Banking Supervision (BCBS), Results of the Comprehensive Quantitative Impact Study, Bank for International Settlements, Basel, 2010


• Kashyap, Anil K., Raghuram G. Rajan, and Jeremy C. Stein, Banks as liquidity providers: an explanation for the coexistence of lending and deposit-taking, Journal of Finance, 2002


• Nobes, C., The survival of international differences under IFRS: towards a research agenda. Accounting and Business Research, 2006


• Perry, J., Risk management –an approach for project managers, Butterworth & Co, 1986

• Power Michael, The risk management of everything: rethinking the politics of uncertainty London, Demos, 2004

HB-SOR: Hybrid Bat Spectrum Map Empowered Opportunistic Routing And Energy Reduction For Cognitive Radio Ad Hoc Networks (CRAHNs)

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ABSTRACT: Cognitive Radio becomes a new technology for increasing the spectrum efficiency by means of creating opportunistic transmission links. Maintaining the routing information to opportunistic links is designed for packet transmission in a CR Ad Hoc Network which consists of cooperative relay multi-radio systems. This paper proposes a new CR routing Protocol (CRP) for CRAHN with the purpose of distinctively addresses the end-to-end performance in terms of throughput and delay. Hybrid Bat Spectrum map empowered Opportunistic Routing (HB-SOR) algorithm to compact with transmission delay over opportunistic links. A probable investigate HABC-SOR algorithm be able to study the relationship among end-to-end delay and throughput. Based on the theoretical definition of HB-SOR protocol, it is simulated to normal and large-scale CRAHNs among wireless fading channels, utilize a cooperative networking procedure to allow multipath communication between nodes with consistent end-to-end transportation. In addition the proposed HB-SOR protocol also calculates the energy value of the received signal inside the bandwidth threshold and time period. Here the computed energy is compared to a predefine threshold to find the current status (presence/ absence) of the transmitted signal. From the simulation results it confirm that proposed HB-SOR protocol results less end-to-end delay, high throughput and less communication overhead appropriate to theoretical examination.

Keywords: Cognitive Radio (CR) networks, cooperative relay, Dynamic Spectrum Access (DSA), opportunistic routing, spectrum map, Hybrid Bat based Spectrum map empowered Opportunistic Routing (HB-SOR).

I. INTRODUCTION

Advanced development and usage of wireless technologies and wireless communications such as 3G cellular phone, laptop, and tablet PC in the world, they require more spectrum resources. But in the present spectrum structure, each and every one of the frequency bands are completely assigned to particular services, and it is easily destructed by unlicensed users. The Federal Communications Commission (FCC) has designated with the intention of the percentage of the assigned spectrum with the purpose is occupied simply from 15 to 85
percent; it should be varied commonly based on their time and places [1]. To address the problem of spectrum insufficiency, the FCC has been recently proposed by authors to allocate spectrum bands for unlicensed devices in licensed bands. This motivates to focus on the development of new Cognitive Radio Networks (CRNs) technology to improve the spectrum efficiency.

"CR" is a radio with the purpose of has the sensing capability, and be able to modify its transmitter parameters based on their interaction in CR Ad Hoc Network (CRAHN). Thus, CR preserve make use of the existing wireless spectrum opportunistically. The functions in the CRNs is performed between two users generally that is Secondary users (SUs) also named as unlicensed users, and Primary users (PUs) also named as licensed users are absent, however they require to free the band once the primary user is distinguished. Furthermore, a method called Cooperative Communications (CC) has been introduced in [2] to defend against the fading effects, and might enhance the channel capability. In [3] shown with the purpose of CC could provides some remuneration in CRNs. For example, SU could communicate the traffic of a PU in the direction of the intended destination or preserve the signal-to-noise ratio at CR receiver in the location with the purpose of CR sender by means of low transmission power subsequently as to defend the PUs. Since spectrum is expensive resources in CRNs, the major aim of this work is to use the available resources as many as probable during this cooperative technology with the purpose of can increase the throughput among SUs. However many of the researchers in CRNS is performed based on the single-hop communications. Accordingly, reducing end-to-end delay and increasing the throughput in CRAHN becomes a promising research field.

In CRAHN, Dynamic Spectrum Access (DSA) permits several CRs users with the direction to access the transmission prospect subsequent to distinguishing the spectrum hole from exploitation of Primary System(s) (PS) [1]. Once successful DSA is obtained, the packets appropriate in the direction of successful influence of transmission opportunities might be related to the destination node, applied to multi-hop networking. On the other hand, CRAHN routing still becomes a very challenging task. In the recent work research investigation is performed based on the homogeneous ad hoc networks, start-networks, or mesh networks for spectrum utilization of CRN to assist routing in CRAHN [4-6]. On the other hand, they might not perform based on the stochastic and dynamic nature of CR links into routing. In the direction of dynamically right to use the preassigned spectrum bands, CR must gather and process information regarding co-existing users inside the spectrum of interests, which needs advanced sensing and signal-processing qualifications [7].

By the motivation of spectrum sensing [8], sensing information among CR’s transmitter (CR-Tx) and the CR’s receiver (CR-Rx) becomes a very challenging task. This motivates the development of spectrum map over probable routing paths. The spectrum map demonstrates the obtainable spectrum through geographic area, during sensing and locationing, and several methods have been proposed in the recent work regarding spectrum map [9]-[10] in the dynamic and the opportunistic nature of a CRAHN. The spectrum map provides an information aggregation in the direction of preserve cumulative information in a consistent manner and in a resource-
efficient manner. From the obtainable link and heterogeneous CRAHN [11] present an additional challenge in the routing algorithm, cooperative communication in the direction of preserve transmissions in a dynamic manner become very challenging task.

Some of the work proposed in the literature for opportunistic routing in CRAHN is discussed as follows: Spectrum-Tree base On-Demand routing protocol (STOD-RP) [12] is proposed in the literature and spectrum-tree is created to each spectrum band. The development of the spectrum-tree addresses the problem of spectrum sensing and route selection for dynamic nature of CRAHN. However new route metric is also proposed in the literature to solve the problem of spectrum-adaptive route recovery method. It shows that the proposed STOD-RP protocol decreases the communication overhead and decreases the average end-to-end delay considerably. Hou et al [13] designed a new mathematical framework for minimizing the essential network-wide radio spectrum resource proposed for a position of user sessions. Since this formulated representation is worked based on the Mixed-Integer Non-Linear Program (MINLP), which is generally NP-hard problem, develop a lower bound designed for the purpose by means of relaxing the integer variables via linearization technique. Consequently, propose a near-optimal algorithm to solve MINLP problem. This MINLP is implemented based on the novel sequential fixing procedure, where the integer variables are computed in iteration manner by means of using sequence of linear programs. Simulation results demonstrated that the proposed relaxation provides near-optimal results via the use of lower bounds when compare to existing methods.

Chowdhury et al [14] study the problem of TCP newReno in a CRAHN by proposing window-based TCP protocol. This proposed TCP protocol integrates the spectrum awareness by means of a combination of explicit feedback beginning the in-between nodes and the destination. This have been obtained by adapting TCP rate control algorithm from source to destination via physical layer channel information. In the link layer stage spectrum sensing and buffer management is performed, and a analytical mobility framework with the purpose is introduced at the network layer. An examination of the predictable throughput in TCP CRAHN is presented, and experimentation results provides considerable improvements when compare to other methods for CRAHN. Gymkhana routes the information across paths with the purpose of avoids network zones with the intention of do not assurance steady and high connectivity [15]. Based on this objective, new Laplacian spectrum of graphs based mathematical framework is developed which permits a complete evaluation of the different routing paths in CRAHN. This approach is used to determine effective routes under high connectivity. They use a distributed protocol in the direction of gather some key parameters connected to candidate paths beginning a source to a destination. The parameter is feed addicted to a basic statistical formation which is second hand to calculate capable routing paths not including high stable and high connectivity.

Cooperative Communications (CC) has been also used in the literature that considerably enhances the channel capacity of wireless networks. On the other hand, many of the work in the literature are applied to only single-hop wireless networks [16]. In order to use the benefits of CC in multi-hop wireless networks, a new joint optimization
model is proposed in the literature for node allocation and optimal routing for current sessions. Here the problem of CC in multi-hop wireless networks is solved via the use of the branch-and-cut framework that reduces the computation time and increase the network size. Feng and Yang [17] solves the problem of throughput of secondary networks for DSA networks. They proposed a new mathematical model to measure the collision of together primary network and secondary network settings based on their network performance. The correlation among both networks is measured via the use of spectrum sensing and interference avoidance model. Simulation design demonstrated that the proposed work performs well when compare to existing models in terms of throughput and less connectivity capacity.

Yazane et al [18] solves the problem of throughput and coding overhead simultaneously. By consideration of neighboring nodes in the three-node chain topology via the use of single-server queuing model between two buffers. Here the results of the increased throughput value are measured via the use of continuous-time Markov chain model, and the examination is validated during simulation. Simulation results demonstrate that the three-node chain topology results high throughput and less coding overhead. Khalifé et al. [19] designate with the purpose of the proper time designed for opportunistic forwarding in CRAHN relays on the proportional timescale of the primary bands' idle time through cognitive communication time period. It is noted with the intention of the opportunistic routing related in [18]. On the other hand still there is lack of problem occurs in realistic routing algorithm for CRAHNs such as network size, depending on their mathematical examination of data transportation via the use of opportunistic communication links appropriate to wireless fading, access, and operations.

The remainder of this paper is organized as follows: in section 2, proposed hybrid bat based spectrum opportunistic routing algorithm and energy detection are presented, and section 3 focuses on the performance evaluation.

II. PROPOSED HYBRID BAT BASED SPECTRUM OPPORTUNISTIC ROUTING ALGORITHM AND ENERGY DETECTION

In CR Ad Hoc Network (CRAHN), two factors which majorly affects the performance of dynamic spectrum accessibility. The first factor is primary user activity. Here Cognitive Users (CUs) are considered as low priority and those users are named as secondary users for spectrum accessibility to primary users, CUs should sense the spectrum to differentiate PUs activity. The second factor is spectrum accessibility in CUs via dynamic opportunistic links. This factor majorly affects the performance results of CRAHN, in terms of end to end delay and throughput. So, appropriately supporting a dynamic opportunistic links in efficient routing is extremely significant in CRAHN [20]. Solve above mentioned problems in CRAHN, new CR routing protocol (CRP) is proposed for CRAHN by satisfying network parameters like less end-to-end, high throughput and less delay. Hybrid Bat Spectrum Opportunistic Routing (HB-SOR) algorithm is designed to compacted with less transmission delay in CRAHN. A possible examine HB-SOR algorithm is able to study the relationship among end-to-end delay and throughput of multihop communications via Markov chain modeling to considerably keep the less communication overhead in CRAHN. Proposed HB--SOR algorithm is used to utilize
opportunistic links for CRAHN to obtain high throughput, for this purpose first need to define a system model.

System model: To simulate and develop the procedure of spectrum map for HB-SOR algorithm, make assume a CRAHN paradigm [7], [27], [28] by considering concurrent PSs' and CRs' transmissions minimally if the interference created through CR-Txs at the PS's receivers (PS-Rxs) is less than the threshold. For performing this task first formulate a network model and define four types of traffic models which are applied to large-scale CRAHNs.

This model is similar to network model [15],[28], it is a whole CRAHN topology which consists of a CR source (CRs), a CR destination(CRD), number of Cooperative Relay Nodes (CRRs) is able to forwarding the packet(s) from source to destination and primary mobile stations (PSs) during its communications. Destination nodes in the CRAHN forward the traffic via relay nodes without consideration of PSs' support and check PSs' transmission at initial stage of interruption itself. Let us consider there are \( n \) CR nodes with limited CRD in CRAHN. The ith CR node has \( T_i \) feasible opportunistic paths where, the jth opportunistic path in \( P_{ij} = \{P_{i1}, P_{i2}, \ldots, P_{iT_i}\} \), which is called as the opportunistic paths. These opportunistic paths consist of \( L_{ij} \) links to CRD. Here spectrum map substitute as an information aggregation platform for all kinds of sensing and inference results. This platform is applied to CRAHN functions and specify the available spectrum through the geographic area.

In the existing spectrum map, CR-Tx will keep the power level and check the interference to the PS-Rx via the reciprocal inference model as illustrated in Fig. 1. In wireless communication during transmission, communication may be eavesdropped by CR-Tx from a PS-Rx's location, while PS devices are in RTS-CTS. In order to obtain the interference to PS-Rx and CR-Tx we need to measure the distance from the channel model for PS-Rx to CR-Tx. This results position the distance into the conversely channel model.

Fig.1. Wireless overhearing phenomenon between heterogeneous CR and PS devices

The CRs' observation is used to take system view as slotted and unslotted, which differentiate the interaction between PSs' and CRs' traffic. Here CRS and CRD are synchronous with time slot, and the sth time slot \([t_s, t_{s+1})\) is equal to \( \Delta t \), where \( s \in I \). PS's transmission activity is modeled via two-state Discrete-Time Markov Chain (DTMC), here spectrum accessibility is denoted with state “1” and spectrum unavailability is denoted with state “0” to opportunistic link [19]. In each slot (i.e.,\( \Delta t\))s, for every CR transmission when PS is dynamic/inactive, the entire \( \Delta t \) is occupied/presented. Conversely, the traffic flow concept is implementing for the unslotted view with the purpose of interruption of CR's link utilization should be achieved by PS's traffic. Thus, each CRAHN has either slotted or unslotted system view. Here any two types of types of data packet patterns are transmitted by PSs' and CRs' transmitter-receiver pairs. The deterministic packet size propose with the purpose of \( \Delta t\)s is equivalent to \( \Delta t \) for all time slots. This means to facilitate in each time slot, a single packet is able to be transmitted for PS's or CR's traffic, let us consider that the PS and CR have the equal

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packet size. Here variable packet in unslotted system is communicated by exponential distributed packet size.

A. Spectrum Availability via Markov Chain Modeling

In this step transmission might not be interrupted by other’s traffic patterns from the CR-Tx over opportunistic link. Particularly, PSs’ second-hand spectrum blocks should not be affected by CR-Tx's transmitted power next to the route to CR-Rx. Furthermore, PSs should not use the CR-Rx’s unavailable block for successful reception from CR-Tx. Here the spectrum block length is computed by the area with the purpose of CR-Rx be able to perform successful signal reception, even under interference. Thus, the blocks that are required to be vacant by Mk for CR's transmitter-receiver pair of the kth link follows

\[
d \leq \frac{d}{\pi} \leq \frac{d}{\pi} \frac{\pi}{d} \leq \frac{\pi}{d}
\]

where \( d \) is the distance between source to destination. It presents the orthogonal property among PSs’ and CRs’ spectrum procedure in the spatial domain to underlay paradigm. For this spectrum blocks, three statistics of spectrum measurement are calculated as described as follows: traffic load \( \phi \), correlated spectrum block for PS \( \eta \); and usage dependence for PS \( \xi \). \( \phi \) states the ratio of the spectrum block which are occupied and be able to be known related to the direct decision from the location in the map i.e., \( \phi \) is either 0 or 1 or \( \phi = NPS/N \) single spectrum block is selected in a uniform way. \( \eta \) and \( \xi \) specify the spectrum block usage dependency for PS[27],[28].

B. Wireless fading schema

transmit a packet of the kth link of the Pij path for the ith CR's transmission and it is modeled using a Bernoulli process. During this some parameters need to be considered that is successful transmission rate \( \psi \), received Signal-To-Noise Ratio (SNR) SNR, is not lower than the threshold \( k \). For path-loss and shadowing environment, the received power at known distance from the transmitter is lognormally distributed and,

\[
\psi = 1 - Q\left(\frac{P_{min} - P_s - 10 \log_{10} K + 10 \log_{10} \left(\frac{d}{d_0}\right)}{\beta^2}\right)
\]

where \( P_s \) is transmitted power level at source, and \( P_{min} \) is minimum received power level at source. \( d_0 \) is a reference distance for antenna, and \( d \) is the distance between the transmitter and the receiver. \( K \) is a threshold related to antenna characteristics and the average channel attenuation. \( \alpha \) is the path loss component and \( \beta \) is the shadowing parameter is modeled via lognormal distribution with mean 0 dB and standard derivation \( \beta \). C. Link service rate:

Traffic patterns are second-hand to develop transmission, which consist the service time of opportunistic links. On related to deterministic packet size, the service time is predefined and is equal to \( \Delta t \) for each CRs’ packet transmission. On the other hand, for variable packet size, diverse fundamental wireless fading channels [11] such as lognormally distributed model for large-scale fading, Rayleigh fading for small-scale fading, and the fast-fading model are considered to obtain the service rate.

Deterministic Packet Size in Slotted or Unslotted System (DS or DU) follows the model of opportunistic link as M/D/1/\( \infty \)/FCFS queue. In M/D/1/\( \infty \)/FCFS model wireless fading channel is named as an erasure channel and has packet loss. Consequently packet is transmitted from source to destination via a Bernoulli process with successful transmission rate \( \psi \). Let us consider \( Y \sim Geo(\psi) \) represents the successful transmission rate and \( X \sim Geo(\gamma) \) represents the obtainable probability from opportunistic nature. Here \( X \) and \( Y \) are uncorrelated from independent events, and total service time \( S \) which sum of \( X \) to \( X_Y \) for slotted systems. Similarly for unslotted systems, the successful transmission rate for PSs’ or CRs’
traffic is represented as $v_{PS}$ or $v$, correspondingly. The spectrum accessibility is a Bernoulli procedure by means of probability

$$g_{DU} = \prod_{k=1}^{m_k} (\psi_{DU} g_{C})$$

(2)

$\psi$ is the probability of a wireless fading channels during transmission at the observation time, and

$$\psi = 1 - \frac{\lambda_s \Delta t}{v_{PS}}$$

(3)

$\Delta t$ is the period of time. $g_{C}$ is the probability of the residual available time during transmission time is described as follows,

$$g_{C} = 1 - \sum_{k=1}^{\infty} \left( 1 - \frac{\lambda_s \Delta t}{v} \right)^{k-1}$$

(4)

$$= v \exp^{-\lambda_s \Delta t} \left( 1 - \exp^{-\lambda_s \Delta t} + \exp^{-\lambda_s \Delta t} \right)$$

Consequently, assume the $M/Geo/1$/$\mathcal{H}$CFS queue model through Geo(cDU), where cDU is equivalent to $g_{DU} v$

Variable Packet Size in Slotted or Unslotted System (VS or VU) follows the model of $M/M/1$/$\mathcal{H}$CFS queue was opportunistic link with successful transmission rate. Here consider $\mu$ represents the exponential service rate and spectrum accessible probability in Bernoulli distribution, the $\mu s$ service rate is geometrical sum of exponential distribution. Have $M/M/1$/$\mathcal{H}$CFS queue with service rate $\mu_{CS}$ for the slotted case. In an unslotted system, spectrum accessibility follows the procedure of Bernoulli distribution which is described as follows,

$$g_{V} = \prod_{k=1}^{m_k} (\psi_{V} g_{V})$$

(5)

Where $\psi = 1 - \frac{\lambda_s}{\mu_{PS}}$ and $g_{V} = \frac{\mu_{CR}}{\lambda_s + \mu_{CR}}$

Accordingly, $M/M/1$/$\mathcal{H}$CFS have the queue model results $\mu_{VU}$ service rate, where $c_{VU}$ is equal to $g_{DU} v$

D. Opportunistic Link Delay:

In the unslotted system, CR’s traffic might be intervened via PS’s traffic in the current slot of CR’s transmission. Here $\lambda$ is denoted as CR’s traffic arrival rate for successful transmission rate $v$ and the $\lambda_{S}$ traffic arrival rate of PS’s. For known packet size, the spectrum access probability for CR’s traffic is denoted as $g_{DU}$, and the successful transmission rate of PS’s traffic is $v_{PS}$. For variable packet size, the traffic service rate of the CR’s is denoted as $\mu$ with spectrum access probability $g_{DU}$, and the $\mu_{PS}$ is denoted as PS’s traffic service rate. The Opportunistic link delay within the VU case is defined as follows,

$$\frac{1}{\mu_{VU}} + w_{q} = \frac{1}{\mu_{VU}} - \frac{1}{\mu_{VU} - \lambda_{PS}}$$

(6)

As mentioned above, for the DS case

$$\frac{\mu_{VU} - \lambda_{PS}}{2(c_{S} - c_{VU})}$$

(7)

As mentioned above, for the VS case

$$\frac{1}{\mu_{VU} - \lambda_{PS}}$$

(8)

E. Opportunistic Path Delay:

In this work multi-hop communication is performed between paths in the CRAHN. Derive the multihop path delay through considering two-hop opportunistic paths and then expanding to N-hop opportunistic paths. So initially, two-hop opportunistic path delay for the DU case is defined as follows,

$$\left( \frac{\alpha_{2} - \alpha_{1}}{2(c_{S} - c_{DU})} \right) + \left( 1 + \frac{E(S_{2}) - 1}{1 - R(S_{2})} \right)$$

(9)

packet arrival rate $\alpha_{1}$. Then, the delay is defined as follows,

$$E[w_{1} + w_{2}] = \frac{1}{\mu_{VU} - \lambda_{PS}} + \frac{1}{\mu_{VU} - \lambda_{PS}}$$

(10)

It follows from unslotted cases, for the DS and VS case, the path delay is respectively defined as follows,

$$\left( \frac{\alpha_{2} - \alpha_{1}}{2(c_{S} - c_{VU})} \right) + \left( 1 + \frac{E(S_{2}) - 1}{1 - R(S_{2})} \right)$$

(11)

and

$$\frac{1}{\mu_{S} - \lambda_{PS}} + \frac{1}{\mu_{S} - \lambda_{PS}}$$

(12)

Large-scale CRAHNs make use of large size network, which might be differentiating by spatial distribution of nodes [21, 27, 28]. They define four kinds of node deployment scenarios such as primary interference protocol model, n interferences protocol model, physical model, and per-node based model.
fundamentals such as power control and radio resource allocation for networking under CRAHN and applied them to one-hop forwarding ability of CR relay via stochastic geometry examination as follows, 1) Power Control schemas is used to attain an underlay model under large-scale CRAHNs, power control schemas are used in CRs' transmissions by considering two steps as which is described as follows: i) The maximum power with the purpose of CR-Tx is determined from the reciprocal inference. ii) CR-Rx's Signal-to-Interference-plus-Noise Ratio (SINR) is determined via the spectrum map.

Let us assume that these different deployment scenarios have been performed under a fixed region. In addition, the mathematical model handles over receiver SINR, which gather the effects from every interferer via location. The avoidance region is not predefined anymore and should rely on node density. The per-node based schema depends on effective distance determined from the given map and might not need any location information of nodes. It gives each specific transmitter by means of dedicated power control in a distributed way, certifying its achievability.

Link Service Rate from Radio Resource Allocation: From different type of traffic patterns between CRs' and PSs', consider radio resource allocation designed for the service process of opportunistic links following power control procedures. From mathematical point of view, the outage probability is \( q_T \), and service rate of opportunistic link by means of capacity \( C \) designed for CR's packet is \( \mu_T = q_T BC \), where \( B \) is denoted as packet per bit which rely on packet size. Let us consider this under engineering modeling, \( q_P \) is second hand for the geometric service rate in known packet size, and the service rate is denoted as \( \mu_p = BW \log_2(1 + \text{SINR}) \) derived from Shannon formula. Let us assume that unslotted systems is varied from regular CRAHNs with the purpose of accept accessible probability to differentiate the opportunistic nature, actual PS's arrival traffic is accurately disturbed in large-scale CRAHNs. With the intention of CR's link transmission can be interrupted by PS's traffic anytime. This kind of link transmissions, non-preemptive priority queue \([22]\) is implemented, while PS's traffic is Poisson arrival rate \( \lambda \), and its service rate is \( q_{PS} \) for known packet size and \( \mu_{PS} \) designed for variable one.

Protocol Model of \( n \) Interferences is applied to PS-Rxs and CR-Rxs given \( \epsilon \) and \( P_R \), the successful transmission probability,

\[
q_T = \exp\left(-\frac{\text{HH}}{\text{PP}}-\frac{\text{PP}}{\text{HH}}\right) \times \prod_i \frac{\text{PP}}{\text{HH}}^{\frac{\text{PP}}{\text{HH}}}
\]

Obtain \( \text{P}_{\text{ST}} \), given \( \text{TR} \)

\[
q_T = \exp\left(-\frac{\text{HH}}{\text{PP}}+\frac{\text{PP}}{\text{HH}}\right) \times \prod_i \frac{\text{PP}}{\text{HH}}^{\frac{\text{PP}}{\text{HH}}} + \text{HH} \text{PP}
\]

where \( i(j) \) is \( P \) for PS and \( S \) for secondary CR. It involves two major steps to conclude \( q_T \) for a CR's transmitter–receiver pair.

Per-Node-Based Model is performed based on the “effective distance” under geographic area to signal propagation in fading channels. Known power level of transmitter PTx, the power at receiver PRx, and the interferences from other transmitters being ignored in the spectrum map, the successful distance is determined as follows,

\[
f(x) = d_{\text{eff}} = \left(\frac{\text{PB}}{\text{PB}}\right)^{-\alpha}
\]

Transferring the original map into an optimal distance among the transmitter–receiver pair, straightforwardly obtain the necessary location information and make use of the power control in the per-node-based model. By

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considering different node deployments, the above descriptions gives the details about one-hop forwarding capability of CR relay in terms of delay applied to large-scale CRAHNs.

F. Develop Hybrid Bat Spectrum Opportunistic Routing (HB-SOR) for routing under large-scale CRAHNs.

The Bat algorithm use sonar echoes to determine the power range with effective distance and avoid obstacles. It is commonly identified with the intention of pulses rates are transformed into a frequency which reproduce from obstacles [23]. The pulse rate is defined under 10 to 20 times per second, wavelengths is defined between 0.7 to 17 mm or inbound frequencies of 20-500 kHz. The pulse rate under the range of 0 to 1, where 0 means that is less effective distance and 1 means that is maximum [23]. The bat behavior [23], [29] used three generalized rules during implementation:

1) All the nodes in the CRAHN utilize an echolocation to determine the power range with effective distance and by considering their objective function \(d_{\text{eff}}\) with their conditions barriers in a fairly magical manner.

2) When searching to explore the power range with effective distance, the nodes fly randomly with velocity \(v_i\) at nodes position \(x_i\) with fixed frequency \(f_{\text{min}}\). At the same time as with varied wavelength \(\lambda\), loudness \(A_0\). Based on these value pulse emission rate \(r \in [0, 1]\) is adjusted automatically with their power range.

3) Although the loudness could be varied depending on their power range, initially it varies from a positive \(A_0\) to a minimum constant value \(A_{\text{min}}\). In this work BAT algorithm, initialization of the nodes in the CRAHN is randomly performed. Optimal power range with effective distance is determined via moving virtual nodes (bats) related to the following equations:

\[
\begin{align*}
Q^{(t)}_i &= Q_{\text{min}} + (Q_{\text{max}} - Q_{\text{min}})U(0,1) \\
v^{(t+1)}_i &= v^{(t)}_i + (x^{(t)}_i - d_{\text{eff}})Q^{(t)}_i \\
x^{(t+1)}_i &= x^{(t)}_i + v^{(t)}_i
\end{align*}
\]

where \(U(0, 1)\) is a uniform distribution. A random walk with shortest utilization is used for exploring the power range with effective distance that modifies the current best power optimal solution related to following equation:

\[
x^{(t)} = d_{\text{eff}} + \epsilon A^{(t)}_i (2U(0,1) - 1)
\]

With the power level of transmitter \(PT_x\), the power at receiver \(PR_x\), and the effective distance is considered as the cost value of the ith solution. where \(\epsilon\) the scaling factor, and \(A^{(t)}_i\) the loudness. The local search is performed based on pulse rate \(r\) which increases or decreases depending on the cost value and the loudness \(A_i\) decreases or increases respectively. Precisely, these characteristics are performed based on the following equations:

\[
A^{(t+1)}_i = \alpha A^{(t)}_i, r^{(t)} = r^{(0)} \left[1 - \exp\left(-\gamma \epsilon\right)\right]
\]

where \(\alpha\) and \(\gamma\) are constants. These parameters are optimized using differential crossover and a differential selection thus adds a scaled difference among these operations to determine mutation. Final operation is mathematically expressed as follows:

\[
u^{(t)}_i = w^{(t)}_i + F(w^{(t)}_i - w^{(t)}_j)
\]

where \(F \in [0.1, 1.0]\) denotes the scaling factor , \(r_0, r_1, r_2\) real numbers. Mathematically, uniform crossover can be expressed as follows:

\[
z_{ij} = \begin{cases} u^{(t)}_{ij} \text{rand} \in (0.1) \leq CR \{ j_{\text{rand}} \} & \text{if CR} \\ w^{(t)}_{ij} & \text{otherwise} \end{cases}
\]

where \(CR \in [0.0, 1.0]\) controls the fraction of parameters . Note, the relation \(j = j_{\text{rand}}\) confirms that the
Mathematically, differential selection is defined as follows:

\[
   w_i(t) = \begin{cases} 
   z_i(t) & \text{if } f(Z(t)) \leq f(Y_i(t)) \\
   Y_i(t) & \text{otherwise}
   \end{cases}
\]  

(23)

\(G.\) **Algorithm 1 (HB-SOR)**

1) Traffic is partitioned and encrypted by source into batches of packets for transmissions.

2) At each available time slot of sources, Source collects link information (i.e., \(\delta_{i,j}\) and \(\nu_{i,j}\), \(\in\) \{CRS, n, CRD\}) from the map to prioritize forwarders into the candidate list regarding node metric \(m_i\), \(i \in n\), randomly mixes packets in a batch via HB( ), and broadcasts coded packet with the list.

3) The ACK message is not sent by Destination,
   a) Step 2 is repeated by source until it receives ACK.
   b) For each relay node \(z\), if a packet is received by \(z\) from node \(y\), it splits the packet, collects unheard information and saves in its buffer, as well as checks the list.
      i) If \(z\) lies before \(y\) in the list, \(z\) advances its counter by its triggering ratio \(\phi\).
   c) At each \(z\)’s available time slot, \(z\) examines whether its counter is positive.
      i) If so, \(z\) randomly mixes its buffered packets, broadcasts coded packet with the list, and decrements its counter by one.

4) Destination continuously decodes the collection of coded packets to verify whether it gets all packets of the batch. If so, Destination broadcasts ACK back to Source, eliminating the packets buffered in relay nodes and enabling the next transmission batch.

**HB( )**

Step 1: Initialize effective distance sources \(x_i\) and \(v_i\).

Step 2: Define pulse frequency \(Q_i \in [Q_{\text{min}}, Q_{\text{max}}]\) to find new effective distance.

Step 3: Initialize pulse rates \(r_i\).

Step 4: while \((t < T_{\text{max}})\).

Step 5: Generate new effective distance by adjusting frequency and updating velocities and locations/solutions.

Step 6: if \((\text{rand}(0, 1) > r_i)\)

Step 7: Modify the solution using “DE/rand/1/bin”

Step 8: end if

Step 9: Generate new effective distance by flying randomly

Step 10: if \((\text{rand}(0, 1) < A_i \text{ and } f(x_i) < f(x))\)

Step 11: Accept the new solutions

Step 12: Increase \(r_i\) and reduce \(A_i\)

Step 13: end if

Step 14: Rank the bats and find the effective power distance

Step 15: end

Step 16: Postprocess effective power distance results and visualization.

The scheme makes use of opportunistic relay selection concerning transmission qualities of cooperative links into packet delay. Particularly, it proposes triggering ratios with counters and candidate lists in delay point of view.

**II. Spectrum Sensing via Energy Detection**

An energy detector is a mechanism with the purpose of might choose whether the transmitted data packets is not present or nearby in the transmission range setting. This detector might not need any prior information of the transmitted data packets that is size, shape, frequency. The traditional energy detector calculates the energy level of the received data packets over specified time duration and bandwidth. The energy is then compared to threshold value to find the presence or the absence of data transmission [30].
1. Analog energy detector schema is illustrated in Fig. 2. It includes a finite time integrator. Here finite time integrator limits the transmission bandwidth. The output of the integrator is equal to the energy of the received signal of the square law machine.

2. Digital energy detector schema is illustrated in Fig. 3. It includes an Analog-to-Digital Converter (ADC), which converts continuous transmission packets data to discrete samples, and a square law device followed by an integrator.

The integrator output of any detection schema is named as decision statistic or test statistic. This result is compared to predefined energy threshold device by decision device to make the final decision of the existence/nonexistence of transmitted packets.

III. PERFORMANCE EVALUATION

Listing all simulation parameters and values, evaluate HB-SOR, HABC-SOR, SMOR-1 and SMOR-2 simultaneously. All of these algorithms depend upon the size (network models). When the network is small, HB-SOR, HABC-SOR serves as great feasible data transportation. When the network grows larger and local information is not enough for reliable end-to-end routing HABC-SOR takes charge of packet delivery with the aid of global information, for validation the HB-SOR deliberate it over a three-node relay network for variable packet size in a slotted system (i.e., the VS case).

Though it is simple, it clearly reveals the practicability of HB-SOR over opportunistic fading links in regular CRAHNs and the advantage of opportunistic forwarding than a predetermined route strategy through further study in a wireless relay network. Given the area and density settings for PS and CR in Table I, the Poisson network topology is established.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$n + 1$</td>
<td>3</td>
</tr>
<tr>
<td>$\Phi$</td>
<td>[0.1,1] in CRAHN, 1 in Wireless Network</td>
</tr>
<tr>
<td>$\sigma_{SD}$</td>
<td>1</td>
</tr>
<tr>
<td>$v_{SD}$</td>
<td>0.45</td>
</tr>
<tr>
<td>$\Lambda$</td>
<td>[0.9] (pkt/sec)</td>
</tr>
<tr>
<td>$M$</td>
<td>200 (pkt/sec) in CRAHN, 50 (Pkt/sec) in wireless network</td>
</tr>
</tbody>
</table>

In this work to measure the simulation results of various routing methods we use the topology shown in Fig. 4, which is same like as [27], [28] and [29]. A square region of side 1200 m is categorized into 9 square cells of side 400 m. In the simulation setup, totally there are 9 Primary User (PU) locations. In each PU location, totally there are 10 Primary User (PU) locations; it might be designed for data transmissions. Every one PU has an interfering range of 250 m. 49 SUs are positioned in a grid design; the distance among any two neighboring SUs is 160 m. Every one SU has a greatest transmission range of 250 m on every one channel.
Throughput comparison: In order to measure routing methods such as HB-SOR, HABC-SOR, SMOR-1 and SMOR-2 result, first use the throughput performance metric for comparison, in which make an assumption that all PUs be have equivalent ranger of average ON and OFF times. For every one grouping of average ON/OFF times, replicate the simulation 20 times, by means of every time a diverse start to create PU activities, i.e., ON/OFF intervals subsequent an exponential distribution. Throughput comparison results of various routing methods with respect to time is measured based on the following formula.

\[
\text{Throughput} = \frac{\text{packet received}}{\text{amount of packet forwarded}}
\]  

In Fig.5, measure the throughput comparison results by predetermining the average PU ON at sec and differ the normal OFF time beginning time from 3-10 sec. Examine the throughput of all routing methods such as Lower Bounds, Spectrum Mapping Opportunistic Routing 1(SMOR 1), Spectrum Mapping Opportunistic Routing 2(SMOR 2) and Hybrid Artificial Bee Colony based Spectrum Opportunistic Routing (HABC-SOR), HB-SOR respectively. Again, HB-SOR outperforms when compare to other routing protocols. Since the research HB-SOR algorithm might be to study the relationship among end-to-end delay and throughput.

![Fig. 5. BASELINE THROUGHPUT COMPARISON, THE DATA POINTS FOR METHODS, AVG. PU ON TIME = 6 SEC](image-url)

(a) NODE DEGREE

Fig. 6 shows detailed performance comparison results of the various routing methods such as Lower Bounds, SMOR 1, SMOR-2 and HABC-SOR methods respectively, results are measured in terms of node degree and link duration. From Fig. 6(a) examines the resulting of various routing Lower Bounds, SMOR 1, SMOR-2, HABC-SOR and HB-SOR methods under average node without topology control. It observed that the results of HB-SOR with average node degree retains small in the network increases, which moreover build network scalable. In adding together to node degree, the topology control algorithm as well results in longer link duration is shown in Fig. 6(b).
This designate that the resulting topology is more stable and it is probable toward decrease re-routings in the network. To exhibit the success of HB-SOR and HABC-SOR with the further challenge of large-scale CRAHNs, compare SMOR-2, SMOR-1 and Lower bound, which aims to route packets within the shortest path. Under different opportunistic routing algorithms in the network is characterized by activity of PS-Txs. Fig. 7 shows the better performance of HB-SOR from its cooperative variety gain through the aid of cooperative relays.

IV. CONCLUSION AND FUTURE WORK

Cognitive Radio (CR) have been become a new emerging key technology to increase dynamic spectrum utilization via opportunistic transmissions in CR transmitter-receiver link(s). On the other hand, CRs should form a Cognitive Radio Network (CRN) consequently with the purpose of the messages be able to be forwarded from source to destination, on dynamic opportunistic links to multi-radio systems. However, suitable dynamic opportunistic routing in CRN for multi-radio systems still becomes a challenging problem. Hybrid Bat Spectrum Opportunistic Routing (HB-SOR) is proposed to condition cognition ability to the routing protocols in CRAHN, aggregation platform, interference, time duration and end-to-end transmission for wireless fading channels. It also presented the absolute examination with reliable transmission delay CRAHNs via wireless fading channels. An HB-SOR protocol is used to find an end-to-end minimum cost path between a pair of source and destination. Cogitating the dynamic opportunistic nature, the spectrum map is considered as information aggregation platform toward dynamically revise all kinds of sensing and inference results. The simulation results show that proposed HB-SOR not only obtains higher throughput, but also reduces the end-to-end delay and the amount of energy consumption reduces compared to previous work. A simulation result analyzes the throughput and end to end delay performance metrics between proposed HB-SOR protocol and existing protocols by considering the activities of PU and CR nodes. In future work apply this HB-SOR protocol to CC technology; be able to go one step additional to influence the presented recourses in CRNs so as to improve their performance.

REFERENCES


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Prevalence and pattern of injuries among football players in National Squad in Sri Lanka

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Abstract-
The purpose of this study was to identify the prevalence and pattern of injuries among football players of national squad in Sri Lanka. Methodology: The descriptive cross sectional study was conducted with 91 professional male football players, at the grounds when the players were practicing. The data collection was carried out using interviewer administered questionnaire. The ethical clearance was obtained from the Ethics Review Committee, Faculty of Medicine, University of Colombo. Results: Injury prevalence was 95.6%. There were 5.4% players with upper limb injuries, while 83.9% players with lower limb injuries, 3.2% players with back injuries and 7.5% players with head and neck injuries. Among the lower limb injuries 43.5% were knee injuries, 30.8% were ankle injuries, 10.3% were upper leg injuries 7.7% were groin injuries, 5.2% were lower leg injuries and 2.5% were foot injuries. Hip injuries and pelvis injuries were not reported. Types of injuries were inquired into and the result showed 19.3% contusions, 6.5% lacerations, 42.0% strains, 29.0 % sprains and 3.2 % fractures. Dislocation was not reported. It was revealed that cryotherapy 65.3% was the commonest to be used as first aid. Out of injuries, 14.0% had taken 1 day for the recovery, 40.9% had taken 7 days for the recovery, 49.9% had taken more than 7 days for the recovery. After injury 87.1% players had met physiotherapist for treatment. Conclusion: There was a high prevalence of lower extremities injuries than upper limb, spine and head and neck. Of the lower limb, knee joint was the most injured. Strain was the commonest type of injury pattern among the football players. After most of injuries cryotherapy had been used as a first aid. Most of football injuries had taken 7 days to 14 days for the recovery. Many injured players had sought physiotherapy treatment and advice for their injuries.

Index Terms- Upper limb injuries, lower limb injuries, Strain, Cryotherapy

I. INTRODUCTION

Football is currently the most popular sport in the world. Currently, the International Federation of Association Football (FIFA) unifies 203 national associations and represents about 200 million active players, of which about 160 million are men [1]. The incidence of football injuries is estimated to be 10 - 35 per 1000 game hours [1]. One athlete plays on average 100 hours of football per year (from 50 hours per player of a local team, up to 500 hours per player for a professional team. This means that every player will have minimum one performance-limiting injury per year.

Football is a highly athletic sport with rapid deceleration, acceleration, single-stance twists, single-stance ballistic movements and aerobatic maneuvers [2]. Increase velocity causes increase range of motion in all the joints in the lower extremity. This increased joint range of motion may be a predisposing factor for football injuries in the lower extremities [3, 4, 5, 6, 7, 8, 9, 10, 11]. The knee joint is highly susceptible to injury in football players [5, 12] with increasing exposure, and is at higher risk as opponents become stronger and more skilled [13].

The average cost for medical treatment per football injury is estimated to be $150 (U.S. dollars) [6] Considering the number of active football players worldwide, the socio-economic and financial consequences of injury are immense. Although the injury prevention is the ideal method, if injury does occur, treatment procedure should include appropriate medical care, player’s education, cross-training, specific rehabilitative exercises, and a programmed return to playing football [14]. Sports injury management is a vast field with the integration of most of health care professionals. Sport physiotherapy plays an important role in managing football related injuries with the other team members.

In Sri Lanka, a few studies have been on specific sports. In Sri Lanka, the playing conditions are not optimum and the prevalence and pattern of injuries may be different to what is found in research in developed countries. Also the results may not be applicable for Sri Lankan players as the climate conditions, techniques, nutritional state, and knowledge of preventive methods may vary from the other countries. Therefore, it is a need to assess the prevalence and find out the types of injuries among Sri Lankan players. This will allow taking precautions to minimize these injuries and to plan the treatment for them. Knowing the pattern will enable to plan the physiotherapy treatments needed in advance.
II. MATERIALS & METHODS

A descriptive cross sectional study was conducted with a sample of 100 professional football players between 20 - 35 years at the Football Federation of Sri Lanka. The players were playing football for a period of 2 years or more at the time collecting data. An interviewer administered questionnaire was used to collect the data on pattern of injury, injury history, first aid and physiotherapy treatment. A pretest was carried out and the questionnaire was modified according to the responses of participants. Ethical approval for the study was obtained from the Ethical review Committee of Faculty of Medicine, University of Colombo. Data analysis was done by SPSS-17 (Statistical Product and Service Solution) computer software package.

III. RESULTS

Of the 100 invited to participate in the study, 91 agreed giving a response rate of 91.0%. A majority 38(41.8%) were in the age group of 26-30 years. Mean age of population was 27.7 years (SD +/- 3.940, range 20-35 years). While playing some players wore several type of protective equipment. Most of players wore knee brace 17(18.7%) and rarely players wore gum shield 2(2.2%).

Injury prevalence among players was 95.6%. There were 93 injuries recorded among 91 football players. The injury prevalence of each region of the body is shown in Figure 1. There were 5 players with (5.4%) upper limb injuries, 78(83.9%) players with lower limb injuries, 3(3.2%) players with back injuries, 7(7.5%) players with head & neck injuries.

![Figure 1: Distribution of Injury prevalence](image1)

The injury pattern is shown in Figure 2. Types of injuries 91 football players were classified as contusion 18 (19.3%), laceration 6 (6.5%), strain 39 (42.0%), sprain 27 (29.0%), and fracture 3 (3.2%). Dislocation was not reported.

![Figure 2: Distribution of Injury pattern](image2)

A majority of players (78) reported lower extremities injuries among 91 football players. Among them 34 (43.5%) knee injuries, 24 (30.8%) ankle injuries, 8 (10.3%) upper leg injuries, 6 (7.7%) groin injuries, 4 (5.2%) lower leg injuries and 2 (2.5%) foot injuries. Hip injuries and Pelvis injuries were not reported. Of the lower limb injuries, 10 (12.8%) were contusions, 4 (5.1%) were laceration, 36 (46.2%) were strain, 27 (34.6%) were sprain and 1 (1.3%) was a fracture. Dislocation was not reported. There were 3 back injuries were reported among 91 football players. Of these injuries 2 (66.7%) were contusion and 1 (33.3%) was a laceration. Both contusions were lumb region and laceration was thoracic region. There were 2 (28.28) head and 5 (71.42) neck injuries were reported. Of the head and neck injuries, 2 (66.7%) were contusion and 1 (33.3%) was a laceration. Both contusions were head region and laceration was neck region.

Cryotherapy, Bandage and Taping had been used after above injuries. The pattern revealed that Cryotherapy 77 (65.3%) was the commonest to be used. Bandage 26 (22.0%) and Taping 15 (12.7%) had also been used. Of the 18 contusion reported, 12 (66.7%) players had been used cryotherapy. When concern after laceration 5 players had been used cryotherapy, 2 players had been used bandage and 1 player had been used taping. Among strain 33 players had been used cryotherapy, 11 players had been used bandage and 4 players had been used taping. Of the sprain 25 players had been used cryotherapy, 12 players had been used bandage and 10 players had been used taping. There are 2 players had been used cryotherapy after fracture and 1 player had been used bandage after fracture. First aid after each injury pattern is shown in Figure 3.

![Figure 3: First aid after each injury pattern](image3)
taken 1 day to 7 days for the recovery, 38 (40.9%) had taken 7 days to 14 days for the recovery and 18 (19.3%) had taken more than 14 days for the recovery.

Of the 18 Contusions reported, 5 (27.5%) had recovered within one day, 8 (44.4%) had recovered within 1-7 days and 3 (16.7%) had recovered within 7-14 days and 2 (11.1%) had taken more than 14 days for recovery. Of the 6 Lacerations reported, 4 (66.7%) had recovered within 1-7 days and 2 (33.3%) had recovered within 7-14 days. Of the 39 Strains reported, 5 (12.8%) had recovered within one day, 9 (23.1%) had recovered within 1-7 days, 19 (48.7%) had recovered within 7-14 days and 6 (15.4%) had taken more than 14 days for the recovery. Of the 27 Sprains reported, 3 (11.1%) had recovered within one day, 3 (11.1%) had recovered within 1-7 days, 14 (51.9%) had recovered within 7-14 days and 7 (25.9%) had taken more than 14 days for the recovery. Of the 3 fractures reported, all had taken more than 14 days for the recovery. Recovery of each injury pattern is shown in Figure 4. After injury 81 (87.1%) players had met physiotherapist for treatment.

Figure 4: Recovery of each injury pattern

IV. DISUSSION

In the present study, more injuries were identified in the lower extremities. It is expected that more injuries occurred in the lower body due to the fact that football is a sport that involves predominantly the lower body, and that tackles, impacts and movements are mostly below hip level [2-11]. But this is not consistent with a previous study done by Michel et al (2002) [12] showed that different result from their study in upper limb was the most commonly injured part of the body. Reason for this may be because this study was done among young who were, below the 13 years of age. Past studies had shown that prevalence of the lower limb injuries more than 80% [2,10] which is comparable to the 83.9% in the present study while Maehlum, et al (1984) [9] and Owoeye et al (2008) [11] showed less than 60%.

Knee injuries were among the most common injuries in Sri Lankan football players. Knee joint is highly susceptible to injury [5, 12, 13]. Knee is a complex joint where a lot of soft tissues are needed for its stability. Therefore, various stressors can act on intra articular structures of the knee joint and develop a high chance to have a soft tissue injury. If the muscles around the knee joint are not strengthened enough it leads to act more stress on ligaments and cartilages [15]. The knee is a weight bearing joint, which can be damaged by twisting and jarring, and is also subjected to overuse and trauma caused by collisions.

Ankle injuries were second highest injuries while playing football according to the present study and ankle sprain was most prominent injury pattern. There were similar studies had also shown that the prevalence of ankle injuries was nearly 30% [5-7,8]. The ankle is a complex joint that is capable of a wide range of movement flexion, extension, inversion and eversion as well as a combination of other movements [15]. The ankle takes the full weight of the body and the forces that are exerted on it are considerable, particularly in kicking, running and jumping. This might be the reason for high rate of ankle injuries among the football players [16]. Sprain is most common injury pattern of the ankle following strain, contusion and laceration. Football players have to run on uneven surfaces. An unnatural twisting motion of the ankle joint can happen when the foot is planted awkwardly while kicking of the ball; this also may be the reason for ankle sprain. When playing football, ankle is forced to move out of its normal position, which can cause one or more of the ankle's ligaments to stretch or tear [10].

Upper leg injuries are also common among football players. It was 10.8% of this study while strain was the commonest injury pattern. While playing football kicking is a regular activity. In activities such as kicking, an excessive force is applied to the muscles of upper leg and stretched beyond their limits. This may be the reason for upper leg injuries among the football players. Maehlum, [9] also presented similar results in their study with upper leg injury being 13.6% while it was 39.1% in the Dvorak, study [8]. There was 7.7% groin injuries reported in this study. While playing football requires a large hip range of motion, quick stops and starts, and changes in direction. Several past studies had shown that strain was the most common injury pattern of the groin [2,6,8]. Head and neck injuries were the second highest injuries (7.5%) while playing football according to the present study. Headgears reduce the force of impact so that the symptoms associated with mild head injuries are minimized, and ultimately some slight head injuries could be avoided [17]. The players in the present study rarely wore headgears. Football is contact sport. Above factors may be the reason for higher prevalence of head and neck injuries in this study. Michel, [12] reported 7% of head and neck injuries. Fracture was most common pattern of head injury and strain is common one of the neck. There was 5.4% of upper limb injuries in the present study. Football players tend to fall in outstretched hand. This may be the reason for upper limb injuries among football players. Vernon, [8] also showed similar results with 7.5% of upper limb injuries while contusion was most common pattern. Back injuries were 3.2% while contusion was common pattern.

In the present study, cryotherapy, bandage and taping had been
used after injuries. The pattern revealed that cryotherapy (65.3%) was the commonest to be used. Cryotherapy are ease of use, it is low cost, and gives good cosmetic results. These may have been the reasons for popularity of cryotherapy. Owoeye, [11] also showed same result about first aid.

V. CONCLUSION

The prevalence of any injury was very high among football players. There was a high prevalence of lower extremities injuries than upper limb, spine and head and neck. Of the lower limb, knee joint was the most injured. Strain was the commonest type of injury pattern among the football players. After most of injuries, cryotherapy had been used as a first aid. Most of football injuries had taken 7 days to 14 days for the recovery. Many injured players had sought physiotherapy treatment and advice for their injuries. The factors that increase the risk of football injury first need to be determined, so that steps can be taken to develop the much needed injury prevention program. Further studies are recommended on this.

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REFERENCES


Magnetohydrodynamic Flow over a Flat Plate

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Abstract- The hydrodynamic flow over a flat plate in the presence of magnetic field is investigated. The governing non linear partial differential equations of momentum and energy are transformed into non linear ordinary differential equations using the appropriate similarity transformation variables. The transformed non linear differential equations are solved using shooting method along side with finite difference method. The effect of magnetic field, Prandtl number and some other important parameters encountered were discussed. From the result it is observed that the parameters have significant influence on the flow.

Index Terms- Magnet-hydrodynamic flow, Prandtl Number, Nusselt Number, shooting method

I. INTRODUCTION

Over the years, fluid flow over a flat plate has been of utmost interest in the study of fluid dynamics. When a fluid flows over a flat plate, the fluid particles adjacent to the wall adhere to the plate and eventually come to rest. The flow velocity increases in the direction normal to the plate up to a certain extent, beyond which the flow velocity is the free stream velocity. Thus, there exist a region called the boundary layer were velocity gradient is acting. The boundary layer is the layer adjacent to a surface where viscous effects are important.

Magnetohydrodynamics (MHD) is the branch of fluid dynamics that studies the interaction of electrically conducting fluids and magnetic fields. Examples of such fluids include hot ionized gases (plasma), strong electrolytes and liquid metals. The term Magnetohydrodynamics (MHD) is a part of Magneto-hydrodynamics (MHD) that involves applications in water or incompressible fluids. The word Magneto-hydrodynamics (MHD) is derived from magneto- meaning magnetic field, hydro- meaning liquid and dynamics- meaning movement.

The applications of Magneto-hydrodynamics covers a wide range of areas from liquid metals to cosmic plasma. Plasma physicist use the Magneto-hydrodynamics (MHD) techniques for controlling the stability of plasmas confined by magnetic fields in thermonuclear fusion reaction (Khan,2009).

The study of fluid flows is of great importance in engineering applications. The material processing industry employs Magnetohydrodynamics (MHD), where Lorentz force provides a non-intrusive means of controlling the flow of metals. Also, Magnetohydrodynamics (MHD) provides a unique means of controlling the casting and refining processes, therefore has made it possible to produce fine quality material with minimal cost (Khan,2009).

Different researchers have worked on steady flow of an electrically conducting incompressible flow. Jat (2010) worked on two dimensional steady flow of an electrically conducting, viscous incompressible fluid past a continuously moving surface in the presence of uniform transverse magnetic field. The governing boundary layer equations were transformed to coupled differential equation and then solved numerically using the Newton’s Shooting method with Fourth-Order Runge-Kutta integration scheme.

Patel and Timol (2012) worked on the Similarity equations for steady two dimensional laminar incompressible boundary layer flows past a moving continuous flat surface in the presence of transverse magnetic field. The governing equations were transformed and solved using the Maple ODE solver.

Krishnendu et al(2011) studied magneto-hydrodynamic (MHD)boundary layer flow and heat transfer over a plate with slip condition. A complete self- similar set of equations were obtained from the governing equations using the similarity transformation and were solved numerically using shooting method.

Damseh et al(2006) worked on electrically conducting fluid in the presence of a uniform magnetic field. The governing equations were transformed using similarity transformation.

Adel et al(2003) investigated heat and mass transfer along a semi-infinite vertical flat plate under the combined buoyancy force effects of thermal and species diffusion in the presence of a strong non-uniform magnetic field. The similarity equations were solved numerically by using a fourth-order Runge-Kutta scheme with the shooting method.

Hayat et al(2011) worked on electrically conducting fluid in the presence of a uniform magnetic field. The governing equations were transformed using similarity transformation.

Makinde(2010) considered magneto-hydrodynamic (MHD) boundary layer flow with heat and mass transfer over a vertical plate. Magha(2013) worked on heat and mass transfer along a semi-infinite vertical plate under the combined buoyancy force effect. The non linear boundary layer equations were linearized and solved using finite difference method.

Gupta et al(2001) considered three- dimensional flow past a porous plate and established the effects of Hartmann number and suction parameter on velocity and skin friction.
Youn(2000) worked on the unsteady two-dimensional laminar flow of a viscous incompressible electrically conducting fluid in the vicinity of semi-infinite vertical porous moving plate in the presence of a transverse magnetic field. The effects of parameters were discussed.

Hazem(2006) worked on asymptotic solution for hyromagnetic rotating disk flow. The governing equations were transformed using the scaled von Karman’s similarity coordinates. The non-linear ordinary differential equations were solved by a two-point finite difference technique.

Hazem et al(2011) considered the steady hydromagnetic laminar flow of an incompressible non-Newtonian micropolar fluid. The equations were solved under the boundary conditions using central differences for the derivatives and Thomas algorithm for the solution of the set of discretized equations.

(Bhattachrjee et al, 2013) considered laminar incompressible viscous flow over a flat plate. The governing equations were transformed and solved numerically.

(Ramana et al, 2011) worked on the Magneto-hydrodynamic (MHD) effects on the unsteady heat transfer convective flow past an infinite vertical porous plate with variable suction and soret effect. The governing equation were then solved analytically.

(Oahimire et al, 2013) considered the hydromagnetic flow of a viscous fluid near a stagnation point on a linearly stretching sheet with variable thermal conductivity and heat source. The governing non-linear partial differential equations were transformed into non-linear ordinary differential equations using the usual similarity variables. The resulting equations were then solved analytically.

(Yasser et al, 2010) considered the flow of a viscous incompressible fluid over a stretching sheet considering the variation of viscosity and thermal conductivity with temperature. The governing conservation equations of mass, momentum and energy are non-dimensionalized by using appropriate transformation. The resulting systems of coupled ordinary differential equations are solved numerically by using the shooting method.

II. MATHEMATICAL FORMULATION OF MODEL

We consider the steady two-dimensional laminar flow of an electrically conducting viscous incompressible fluid over a flat plate in the presence of a magnetic field.

Continuity equation $\nabla \cdot \mathbf{V} = 0$ (1)

Momentum equation $\rho(\mathbf{u} \cdot \nabla)\mathbf{u} = -\nabla p + \mu \nabla^2 \mathbf{u} + \mathbf{J} \times \mathbf{B}$ (2)

Energy equation $\rho C_p (\mathbf{u} \cdot \nabla) T = K \nabla^2 T + \mathcal{O}$ (3)

Where $\mathcal{O}$ is dissipation. Maxwell’s equation

$$\begin{align*}
\nabla \times \mathbf{H} &= \mathbf{J} \\
\nabla \cdot \mathbf{B} &= 0 \\
\nabla \times \mathbf{E} &= -\partial \mathbf{B} / \partial t \\
\nabla \cdot \mathbf{J} &= 0
\end{align*}$$ (4)

The equation of conservation of electric charge $\nabla \cdot \mathbf{J} = 0$ gives $J_z = \text{constant}$, where the current density is $\mathbf{J} = (J_x, J_y)$. Since the current density $J_y = \text{constant}$, the constant is assumed to be zero and so $J_y = 0$ everywhere in the flow. The magnetic field is written as $\mathbf{B}_y$ which is in the Y-direction and affects the motion while the current density $J_x$ is in the X-direction. The Ohm’s law is given by $\mathbf{J} = \sigma (\mathbf{E} + \mathbf{V} \times \mathbf{B})$

$J_x = \sigma (\mathbf{V} \times \mathbf{B}_y) = \sigma \mathbf{B}_y \mathbf{u}$ (5)

Hence the Lorentz force is given by

$$F = (J_x, x \mathbf{B}_y) = -\sigma \mathbf{B}_0 u^2$$ (6)

Also, from the energy equation

$$\rho C_p (\mathbf{u} \cdot \nabla) T = K \nabla^2 T + \mathcal{O}$$

is assumed to be negligible, $\rho C_p (\mathbf{u} \cdot \nabla) T = K \nabla^2 T$ (7)

The equations become:

- $\nabla \cdot \mathbf{V} = 0$ (8)
- $\rho(\mathbf{u} \cdot \nabla)\mathbf{u} = \mu \nabla^2 \mathbf{u} - \sigma \mathbf{B}_0 \nabla T$ (9)
- $\rho C_p (\mathbf{u} \cdot \nabla) T = K \nabla^2 T$ (10)

Transforming the equations to Cartesian coordinate form the governing equations are:
\begin{align*}
\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} &= 0 \\
\rho (u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y}) &= \mu \frac{\partial^2 u}{\partial y^2} - \sigma \frac{\partial^2 u}{\partial x^2} \\
\rho C_p \left( u \frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} \right) &= k \frac{\partial^2 T}{\partial y^2}
\end{align*}
\tag{11, 12, 13}

With boundary conditions:

At \( y = 0 \) \quad u = U_x, \quad v = 0, \quad T = T_w \quad \tag{14}

As \( y \to \infty \) \quad u = 0, \quad T = T_\infty

**SIMILARITY TRANSFORMATION**

Similarity transformation involves the use of similarity transformation variables to transform partial differential equations into ordinary differential equations.

\[
\eta = \gamma \sqrt{\frac{U_x}{2\nu x}}
\]

\[
\psi = \sqrt{2\nu x U_x} f(\eta)
\]

\[
u = -\frac{\partial \psi}{\partial x}
\]

\[
\theta = \frac{T - T_x}{T_w - T_x}
\]

**SIMILARITY TRANSFORMATION OF MOMENTUM EQUATION**

Using the similarity variables in equation (15), we obtain the following.

1. \( u = \frac{\partial}{\partial y} \left[ \sqrt{2\nu x U_x} f(\eta) \right] \)

\[
u = \sqrt{2\nu x U_x} \frac{\partial}{\partial y} f(\eta)
\]

\[
u = \sqrt{2\nu x U_x} \left( \frac{U_x}{2\nu x} \right) f'(\eta)
\]

\[
u = \sqrt{2\nu x U_x} \left( U_x f' \right)
\]

\[
u = U_x f'
\]

2. \( v = -\frac{\partial}{\partial x} \left[ \sqrt{2\nu x U_x} f(\eta) \right] \)

\[
\eta = y \sqrt{\frac{U_x}{2\nu x}}
\]

Recall that

\[
v = - \left( \frac{U_x}{2x} \right) f' - \eta f' \left( \frac{U_x}{2x} \right)
\]
\[ v = -\sqrt{\frac{U_x v}{2x}} \left( f' + \eta f'' \right) \]

\[ v = \sqrt{\frac{U_x v}{2x}} (\eta f' - f') \]

\[ \frac{\partial u}{\partial x} = U_x \frac{\partial}{\partial x} (f') \]

\[ = -\frac{u_{\infty} y}{2x} \sqrt{\frac{u_{\infty}}{2ux}} f'' \]

\[ \eta = y \sqrt{\frac{U_x}{2ux}} \]

Recall that

\[ \frac{\partial u}{\partial x} = -\frac{u_{\infty} \eta f''}{2x} \]

\[ \frac{\partial u}{\partial y} = U_x \frac{\partial}{\partial y} (f') \]

\[ = U_x \left( \frac{\partial \eta}{\partial y} \cdot \frac{\partial f'(\eta)}{\partial \eta} \right) \]

\[ = U_x \left( \sqrt{\frac{U_x}{2ux}} f'' \right) \]

\[ = \sqrt{\frac{U_x^3}{2ux}} f'' \]

\[ \frac{\partial u}{\partial x} = \frac{\partial}{\partial x} \left( U_x f' \right) \left( -\frac{U_x}{2x} \eta f'' \right) \]

\[ = -\frac{U_x^2}{2x} \eta f'' \]

\[ \frac{\partial u}{\partial y} = \sqrt{\frac{U_x v}{2x}} (\eta f' - f') \left( \sqrt{\frac{U_x^3}{2ux}} f'' \right) \]

\[ = (\eta f' - f') \left( \sqrt{\frac{U_x v}{2x}} \left( \sqrt{\frac{U_x^3}{2ux}} f'' \right) \right) \]
\[
\gamma (\eta f'') \left( \frac{U''_x {v}}{4x^2 {v}} - f'' \left( \frac{U''_x {v}}{4x^2 {v}} \right) \right)
= \eta f' U''_x \frac{2x}{2x} - f'' \left( \frac{U''_x {v}}{2x} \right)
\]
\[
\frac{\partial^2 u}{\partial y^2} = \frac{\partial}{\partial y} \left( \frac{U''_x {v}}{2ux} f'' \right)
\]
\[
\frac{U''_x {v}}{2ux} \cdot \frac{\partial}{\partial y} f''
\]
\[
\frac{U''_x {v}}{2ux} \cdot \frac{\partial \eta}{\partial y} \cdot \frac{\partial f''(\eta)}{\partial \eta}
\]
\[
\frac{U''_x {v}}{4v^2 {x}} f''
\]
\[
\frac{U''_x {v}}{2ux} f''
\]
Therefore, we have
\[
u = U''_x f' \]
\[
v = \sqrt{\frac{U''_x {v}}{2x}} (\eta f'' - f'')
\]
\[
\frac{\partial u}{\partial x} = \frac{u}{2x} \eta f''
\]
\[
\frac{\partial u}{\partial y} = \frac{\eta f'' \cdot \frac{U''_x {v}}{2x} - f'' \cdot \frac{U''_x {v}}{2x}}{2x}
\]
\[
\frac{\partial^2 u}{\partial y^2} = \frac{U''_x f''}{2ux}
\]

We now substitute equation (16) into equation (12)
\[
\rho \left( \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} \right) = \mu \frac{\partial^2 u}{\partial y^2} - \sigma B_0^2 u
\]
\[
\rho \left[ - \frac{U''_x}{2x} \eta f'' + \eta f'' \left( \frac{U''_x}{2x} \right) - f'' \left( \frac{U''_x}{2x} \right) \right] = \mu \frac{U''_x {v}}{2ux} f'' - \sigma B_0^2 U''_x f'
\]
\[
\rho \frac{U''_x}{2x} \left[ - \eta f'' + \eta f'' - f'' \right] = \mu \frac{U''_x {v}}{2ux} f'' - \sigma B_0^2 U''_x f'
\]
\[
\rho \frac{U''_x}{2x} \left[ - f'' \right] = \mu \frac{U''_x {v}}{2ux} f'' - \sigma B_0^2 U''_x f'
\]
(17)
Divide by $\rho_2^2$ and $\frac{\mu}{\rho U_\infty}$ for $\nu = \frac{\mu}{\rho U_\infty}$

For $\rho_\mu = \frac{\mu}{\rho U_\infty}$, we have

$$f'''' + ff'' - Nf' = 0 \quad (18)$$

Where $N = \frac{2\sigma B_0^2 U_\infty}{\rho U_\infty^2} = \frac{m^2}{M^2}$ is the Interaction parameter

$\mu$ = absolute viscosity

$\nu$ = kinematic viscosity

$U_\infty$ = free stream velocity

**SIMILARITY TRANSFORMATION OF THE ENERGY EQUATION**

Transforming the energy equation in equation (13) using the similarity variables in equation (15). The energy equation from equation (13) is

$$\rho c_p \left( u \frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} \right) = K \frac{\partial^2 T}{\partial y^2}$$

From equation (15), we have

$$\theta = \frac{T - T_\infty}{T_w - T_\infty}$$

$$T = (T_w - T_\infty) \theta(\eta) + T_\infty$$

$$\frac{\partial T}{\partial x} = \frac{\partial}{\partial x} \left( (T_w - T_\infty) \theta(\eta) \right) + \frac{\partial T_\infty}{\partial x}$$

1. $\frac{\partial \eta}{\partial x} \cdot \frac{\partial}{\partial \eta} \left( (T_w - T_\infty) \theta(\eta) \right) + 0$

$$= - \frac{y}{2\sqrt{x^3}} \sqrt{\frac{U_\infty}{2\nu}} \left( (T_w - T_\infty) \theta(\eta) \right)$$

$$= - \frac{y(T_w - T_\infty) \theta'(\eta)}{2\sqrt{x^3}} \sqrt{\frac{U_\infty}{2\nu}}$$

2. $\frac{\partial \eta}{\partial y} \cdot \frac{\partial}{\partial \eta} \left( (T_w - T_\infty) \theta(\eta) \right) + 0$

$$= \frac{U_\infty}{2\nu} \cdot (T_w - T_\infty) \theta'(\eta)$$
Since \( u \frac{\partial T}{\partial x} \), we have

\[
u \frac{\partial T}{\partial y} = \sqrt{\frac{U_\infty}{2x}} \eta' f(T_w - T_x) \theta'(\eta) - \frac{U_\infty}{2\nu} (T_w - T_x) \theta'(\eta)
\]

\[
u \frac{\partial T}{\partial y} = \sqrt{\frac{U_\infty}{2x}} \eta' f(T_w - T_x) \theta'(\eta) - \frac{U_\infty}{2\nu} (T_w - T_x) \theta'(\eta)
\]

\[
\frac{\partial^2 T}{\partial y^2} = \sqrt{\frac{U_\infty}{2x}} \eta' f(T_w - T_x) \theta'(\eta) - \frac{U_\infty}{2\nu} (T_w - T_x) \theta'(\eta)
\]

\[
\frac{\partial \eta}{\partial y} \cdot \frac{\partial \eta}{\partial \eta} = \sqrt{\frac{U_\infty}{2x}} \eta' f(T_w - T_x) \theta'(\eta) - \frac{U_\infty}{2\nu} (T_w - T_x) \theta''
\]

Therefore we have

\[
\frac{\partial T}{\partial x} = -\frac{y(T_w - T_x) \theta'(\eta)}{2\sqrt{x^3}} \sqrt{\frac{U_\infty}{2\nu}}
\]

\[
\frac{\partial T}{\partial y} = \sqrt{\frac{U_\infty}{2x}} (T_w - T_x) \theta'(\eta)
\]

\[
\frac{\partial T}{\partial x} = -\frac{(T_w - T_x) \theta'(\eta)}{2x} \eta f U_\infty
\]

\[
\frac{\partial T}{\partial y} = \frac{U_\infty}{2x} \eta'' f(T_w - T_x) \theta'(\eta) - \frac{U_\infty}{2x} (T_w - T_x) \theta f
\]
Substituting equation (19) into the energy equation (13) we have
\[
\frac{\partial^2 T}{\partial y^2} = \frac{U_\infty}{2ux} (T_w - T_\infty) \theta''
\]

Multiply through by \( \frac{U_\infty}{2ux} (T_w - T_\infty) \) and solve for \( \theta'' = \frac{k}{\rho C_p} \theta'' + f \theta' = 0 \)

\[
\frac{1}{Pr} \theta'' + f \theta' = 0
\]

Where \( Pr \) is the Prandtl number.

The transformed equation s for Model 1
\[
f'' + N f' = 0
\]

With boundary conditions

\[
f(0) = 0 \quad f(\infty) = 1
\]

SKIN FRICTION COEFFICIENT

Skin friction coefficient is defined as the non dimensional wall shear stress given by
\[
C_f = \frac{\tau_w}{\frac{1}{2} \rho U_\infty^2}
\]

Where
\[
\tau_w = \mu \frac{\partial u}{\partial y}
\]

And
\[
\frac{\partial u}{\partial y} = \sqrt{\frac{U_\infty^3}{2ux}} f''(0)
\]

Recall that
\[
\tau_w = U_\infty \mu \sqrt{\frac{\rho U_\infty}{2ux}} f''(0)
\]
\[ \tau_w = U_x \sqrt{\frac{\rho U_x \mu^2}{2 \mu}} f''(0) \]
\[ \tau_w = U_x \sqrt{\frac{\rho U_x \mu}{2 x}} f''(0) \]
\[ \tau_w = U_x \sqrt{\frac{\rho U_x \mu}{2 x}} f''(0) \]

Since

\[ C_f = \left( U_x \sqrt{\frac{\rho U_x \mu}{2 x}} f''(0) \right) \cdot \frac{2}{\rho U_x^2} \]

then

\[ C_f = \left( \sqrt{\frac{\rho U_x \mu}{2 x}} f''(0) \right) \cdot \frac{2}{\sqrt{\rho^2 U_x^2}} \]
\[ C_f = \left( 2 \cdot \sqrt{\frac{\mu}{2 \rho U_x}} f''(0) \right) \cdot \frac{Re}{\rho U_x 2x} \]

Recall that

\[ C_f = \left( 2 \cdot (Re)^{-\frac{1}{2}} f''(0) \right) \]

**NUSSELT NUMBER**

The rate of heat transfer in terms of the nusselt number at the plate is given by

\[ Nu = \frac{q}{k(T_w - T_x)} \]  
\[ q = -k \left( \frac{\partial T}{\partial y} \right)_{y=0} \]

Where

\[ \frac{\partial T}{\partial y} = (T_w - T_x) \theta'(\eta) \]

And

\[ Nu = -k \left( (T_w - T_x) \theta'(\eta) \right) \]
\[ Nu = -\theta'(\eta) \]

**SHOOTING METHOD**

We now use the shooting method to convert the boundary value problem to an initial value problem by estimating the missing initial condition to a desired degree of accuracy by an iterative scheme.

**ALGORITHM**

Step 1: Rewrite the equation to obtain initial value problem with initial conditions. Let \( s_k \) and \( s_{k-1} \) be two guessed values for the missing initial condition.

Step II: Integrate the equation with initial conditions and \( f''(0) = s_k \) from \( \eta = a \) and \( \eta = b \). Where \([a,b]\) is the interval.

Step III: Let \( f(s_k,b) \) be the values of \( f \) obtained on integration in step II.
Step IV: Integrate the equation with initial conditions and \( f''(0) = s_{k-1} \).

\[
\delta s_k = \frac{(f(s_k; b) - f(b)) (s_k - s_{k-1})}{f(s_k; b) - f(s_{k-1}; b)}
\]

Step V: compute \( \delta s_k \).

Step VI: Obtain next approximation from

\[
s_{k+1} = s_k - \delta s_k\quad \text{for } k=1,2,3,........
\]

Step VII: stop when \( f(s_k; b) \approx f'(\infty) = 1 \), then go to step two.
Otherwise choose another value for \( s_k \).

Using the mathematical software tool MATLAB, the following results were obtained.

### III. RESULTS AND ANALYSIS

To study the physical behaviour of the flow, the non dimensional velocity, temperature and all the results obtained are presented in tables and profiles respectively.

**Table 1. Effect of magnetic parameter on velocity**

<table>
<thead>
<tr>
<th>( N )</th>
<th>( f'(N=0.5) )</th>
<th>( f'(N=1) )</th>
<th>( f'(N=1.5) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0.8934</td>
<td>0.8327</td>
<td>0.7779</td>
</tr>
<tr>
<td>2</td>
<td>0.9765</td>
<td>0.9327</td>
<td>0.8997</td>
</tr>
<tr>
<td>3</td>
<td>0.9947</td>
<td>0.9767</td>
<td>0.9593</td>
</tr>
<tr>
<td>4</td>
<td>1.0065</td>
<td>1.0005</td>
<td>1.0002</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 2. Effect of prandtl number on temperature**

<table>
<thead>
<tr>
<th>( Pr )</th>
<th>( \theta(Pr=0.72) )</th>
<th>( \theta(Pr=1.5) )</th>
<th>( \theta(Pr=2.5) )</th>
<th>( Pr=3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1.0443</td>
<td>0.98594</td>
<td>0.89524</td>
<td>0.84108</td>
</tr>
<tr>
<td>2</td>
<td>0.91029</td>
<td>0.83556</td>
<td>0.72</td>
<td>0.65154</td>
</tr>
<tr>
<td>3</td>
<td>0.64923</td>
<td>0.58907</td>
<td>0.49619</td>
<td>0.44127</td>
</tr>
<tr>
<td>4</td>
<td>0.32461</td>
<td>0.29454</td>
<td>0.2481</td>
<td>0.22064</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 3: Effect of Prandtl number on Nusselt number

<table>
<thead>
<tr>
<th>N</th>
<th>( -\theta(Pr=0.72) )</th>
<th>(-\theta'(Pr=3))</th>
<th>(-\theta'(Pr=5))</th>
<th>(-\theta'(Pr=10))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.1541</td>
<td>1.0000</td>
<td>0.8487</td>
<td>0.3892</td>
</tr>
<tr>
<td>0.5</td>
<td>1.1602</td>
<td>1.0272</td>
<td>0.8992</td>
<td>0.5493</td>
</tr>
<tr>
<td>1</td>
<td>1.1634</td>
<td>1.0415</td>
<td>0.9250</td>
<td>0.5862</td>
</tr>
</tbody>
</table>

Fig.1 Temperature profile for different values of the prandtl Number pr
Fig. 2 Velocity profile for different values of the interaction parameter $N$
Fig 1 represents the temperature profile for different values of Prandtl. Increase in the Prandtl number decreases the temperature. Figure 2 represents the velocity profile for different values of N which is the magnetic field parameter. From the profile it is seen that increasing the parameter N decreases the velocity. Figure 3 represents the heat transfer profile Nusselt number. Nusselt number decreases as the Prandtl number increases.

IV. CONCLUSION

Steady, two dimensional hydromagnetic flow over a flat plate has been investigated. The equations were transformed using appropriate transformation variables. The resulting governing equations were solved numerically. The effects of the different parameters (magnetic field parameter, Prandtl number, and Nusselt number) obtained from the transformation are also studied.
analysis, it was found that increase in prandtl number results in decrease in temperature and increase in magnetic parameter decreases velocity of the flow. Thus all parameters have significant influence on the flow velocity and temperature.

REFERENCES


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Modern Optical Fiber – Communication Splitter

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Abstract- In this article, we discuss the challenges to offering their services to it. The optical fiber can be used for the many of industrial application and medical applications as well. The optical fiber consists of two media kept one inside the other. The center transparent medium of the optical fiber is called “core” and the outer is cladding. The refractive index of the core will always be higher than the refractive index of the cladding. Our work is inspired by a public fiber access network being built in Australia called the National Broadband Network (NBN) that will deploy fiber to 93 percent of premises, providing broadband access at potential data rates of 100 Mb/s and above. The Sagnac interferometer has expanded from the rotation measuring instrument into These cables had a loss figure of about 20db/km. When operating frequencies increased further the coaxial cables proved to be inadequate and loss, thereby giving rise to the need of another medium called waveguides. These are basically hollow structures which guide the electromagnetic energy from one point to another through them. But as the operating frequency further increased to few hundreds of gigahertz these waveguides too proved to be inadequate as there was no supporting electronic circuitry available that could operate at such high frequencies.

II. AIMS AND SCOPE OF THE JOURNAL
The journal covers research into the design, characterization, and production of structures scales. The electromagnetic energy traveled, along with the lengths of these cables and was confined in between the two metallic layers. These cables had a loss figure of about 20db/km.[7] When operating frequencies increased further the coaxial cables proved to be inadequate and loss, thereby giving rise to the need of another medium called waveguides. These are basically hollow structures which guide the electromagnetic energy from one point to of about 20db/km. When operating frequencies increased further the coaxial cables proved to be inadequate and loss, thereby giving rise to the need of another medium called waveguides. These are basically hollow structures which guide the electromagnetic energy from one point to another through them. But as the operating frequency further increased to few hundreds of gigahertz these waveguides too proved to be inadequate as there was no supporting electronic circuitry available that could operate at such high frequencies.[8]

Index Terms- Sagnac, ubiquitous, Fibre-optic sensor, a chemical sensor, an enzymatic sensor, complete cell biosensor, control of biologicals, tapered optical fibre, optical chemical sensor, chemical equilibrium, biosensors, physicochemical transducer, environmental and clinical monitoring.

I. INTRODUCTION
Fiber-Optic Communication is the most modern and advanced mode of data communication which has very recent roots dating back to not more than 40 years ago. This was the major breakthrough in the field of communication. Right from this time, there has been a continuously increasing need for bandwidth for communication due to continuously increasing the number of users. More people wanted to communicate, and thus large bandwidths were required thereby forcing communication scientists to look for new possibilities. Communication Scientists all over the world were in an incessant search for a wideband and low-loss medium of data communication which could be used at high data rates with the least amount of lost possibly. This constant search, for such a medium, led to the development of optical fiber communication. Let us have a quick glimpse into the history of communication. [3-6].

Motivation – OPTICAL COMFINDMENT
On the very first look, both the questions seem trivial. This is because we already have a lot of sources of light in our day to day life, for e.g. incandescent bulbs, gas bulbs, LEDs, fluorescent
lamps, etc. Then why worry about sources? Similarly, the second question also has a very obvious answer. Fibers are also used for illumination and are wrapped in bundles so that they may opt for a variety of other applications, including sensors and fiber.[9] Lasers. They are used as light guides in medical and other applications where bright light needs to be shone on a target without a clear line-of-sight path. Many microscopes use fiber-optic light sources to provide intensely[10]

![Figure 2: Optical Communication Link through light source](image)

### III. WHY OPTICAL FIBRE

Fibers having attenuations greater than 1 dB/km are rarely used in communication networks. Nevertheless, the attenuation of badly matched fibers may exceed 1 dB/km per connector or splice if they are badly handled during installation stages. A good coupling efficiency requires precise positioning of the fibers to center the cores. The simplest way to avoid connector losses is by splicing the two ends of the fibers permanently, either by gluing or by fusing at high temperatures. Losses in gaps can be viewed as a type of Fresnel loss because existing air space introduces two media interfaces and their associated Fresnel reflection losses. In this case, there are two major losses to be considered. The first loss takes place on the inner surface of the transmitting fiber, and the second loss occurs due to reflections from the surface of the second fiber. One way of eliminating these losses is by introducing a coupler that matches the optical impedances of the two materials.[11-13]

![Figure 3: Absorption with Low-Loss Peak](image)

### Scattering Losses of an optical fiber

Despite the careful manufacturing techniques, most fibers are inhomogeneous that have disordered, amorphous structures. Therefore, high-order modes suffer more losses, thus causing modal dispersions. The modal dispersion is one of the primary cause of rising time degradation for increasing fiber wavelengths. In addition, propagation time varies with an index of refraction. Power losses due to scattering are caused by such imperfections in the core material and irregularities between the junction and cladding as shown in Figure 2. In homogeneities can be either structural or compositional in nature. In structural homogeneities, the basic molecular structure has random components, whereas, in compositional inhomogeneity, the chemical composition of the material varies. The net effect from either inhomogeneity is a fluctuation in the refractive index. As a rule of thumb, if the scale of these fluctuations is on the order of l/10 or less, each irregularity acts as a scattering center. This is a form of Rayleigh scattering and is characterized by an effective absorption coefficient that is proportional to . Rayleigh scattering can be caused by the existence of tiny dielectric inconsistencies in the glass.[15] Because these perturbations are small with respect to the waves being propagated, light striking a Rayleigh imperfection scatters in all directions. Scattering losses are less at longer wavelengths, where the majority of the transmission losses are due to absorption from impurities such as ions. Rayleigh scattering losses are not localized, and they follow a distribution law throughout the fiber.[18] However, they can be minimized by having low thermodynamic density fluctuations. A small part of the scattered light may scatter backward, propagating in the opposite direction. This backscattering has important characteristics and may be used for measuring fiber properties. Usually, the in homogeneities in the glass are smaller than the wavelength l of the light. The scattering losses in glass fibers approximately follow the Raleigh scattering law; that is, they are very high for small wavelengths and decrease with increasing wavelength.[19] In general, optical losses in the glass cause the optical power in fiber to fall off exponentially with the length L of the fiber.
IV. APPLICATIONS OF FIBER-OPTICS

- Mie Scattering
- Rayleigh Scattering

Mie Scattering

Non-perfect cylindrical structure of the fiber and imperfections like irregularities in the core-cladding interface, diameter fluctuations, strains, and bubbles may create linear scattering which is termed as Mie scattering.

Rayleigh Scattering

The dominant reason behind Rayleigh scattering is refractive index fluctuations due to density and compositional variation in the core. It is the major intrinsic loss mechanism in the low impedance window. Rayleigh scattering can be reduced to a large extent by using longest possible wavelength.[20]

V. SYNTHESIS OF OPTICAL- FIBER

This Chapter is devoted to the description of the optical cable installation methods. Each type of optical fiber cable has a specific strain limit, and special care and arrangements may be needed to ensure successful installation without exceeding it. Some of the most difficult situations for the installation of optical fiber cables are in underground ducts. The condition and geometry of duct routes are of great importance. Damage caused by overloading during installation may not be immediately apparent but can lead to failure later in its service life. Also, aspects related to bending during the installation may require special consideration. Consideration should also be given to factors of time and disturbance. Installation equipment may be required to run for long periods of time and the time of day, noise levels, and traffic disruption should be taken into account.[22]

There are many types of cable installation (underground duct, trenchless, mini-trench, aerial, submarine, etc.) are described. Clause 2 deals with additional safety precautions when installing optical cables. In a top-down approach—a large piece of material is cut down to small pieces through different means such as lithography and electrophoresis. In order to obtain a reliable end-to-end network, all different network nodes shall be evaluated using the same methods and metrics.[23]

A network node should be able to fulfill its optical functionalities, including the ability to be reconfigured, in all conditions of the environment, in which the node will reside.

VI. CONCLUSION

The choice of an appropriate emergency restoration method for a damaged optical fiber cable, as well as its permanent repair, depends on the extent of the damage and particularly on the distribution of fiber breaks. The restoration procedures presented below are based on the premise that optical fiber cable systems carry large traffic cross sections and warrant a substantial. Thus, a basic understanding of the mechanics of cable behavior, with regard to the mechanical tension applied to the cable, in damage situations is important in developing and applying these methods. Especially at high optical power levels scattering causes disproportionate attenuation, due to non-linear behavior. Because
of this nonlinear scattering, the optical power from one mode is transferred in either the forward or backward direction to the same, or other modes, at different frequencies [24].

Pump laser at 980 nm or 1480 nm excites erbium doped fiber.

- Erbium fluoresces at 1550 nm, providing stimulated emission gain to the communication signals. The doped fiber thus acts much like a laser but without the end mirrors (single pass).
- Spontaneous emission of the erbium is a noise source, so the amplification comes at the expense of reduced SNR.

VII. ACKNOWLEDGMENT

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REFERENCES


[7] When to use 3D Die-Stacked Memory for Bandwidth-Constrained Big Data Workloadsason Lowe-Power Mark D. Hill David A. WoodUniversity of Wisconsin–Madisonpowerj.markhill,david@cs.wisc.edu


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www.ijsrp.org
Study on Mega Infrastructure Projects in Lahore and its Impact on Traffic System in Lahore & Commute time

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Abstract- A budget of $1.65 billion has been allocated to the Orange Line Metro, Rs 2 billion has been allocated for the signal free jail roads, and overall trillions of Pakistani rupees are being spent on the construction projects and infrastructural development in Lahore. New roads, metro trains, new routes, and new bridges being made at such a high cost have prompted the question of necessity and usefulness of these projects. This study aims to carry out a cost and benefit analysis of these projects by carrying out a survey with the younger generation of Lahore regarding their daily commute on these routes.

Index Terms- Metro, Orange Line, LDA, Punjab, Pakistan

I. INTRODUCTION

Lahore, the capital city of Punjab, has a historic and national significance as it is one of the most prominent cities in the country. Popular for its rich and colorful culture, delicious food, and stunning architecture, this city attracts new projects related to face-lifting of historical areas e.g. the preservation of the Mall Road and the newly introduced double Decker bus for sightseeing. Other beautification projects have been done by the Parks & Horticulture Department in areas of horticulture, and the Punjab Food Authority is also playing a great role in keeping the food quality up to par. The government of Punjab, under supervision of the Chief Minister, has recently overtaken multiple developmental projects that have outshined all the aforementioned ones. One of the initial and prominent projects was the Metro Bus, which was followed by multiple projects of the same type, including the Signal-Free Jail Road route, construction of several underpasses, and the newly introduced Orange Line train. Not every citizen of Lahore considers these efforts of the government as highly applaudable – many consider some of these efforts as over-consumption of the state’s money and rather unnecessary. The amount of money spent by the government on these infrastructural projects alone has surmounted 1.194 trillion [1] in the year2015-16; the Orange Line Metro train project alone will cost $1.65 billion [2]. The huge budget also promises great comfort and solution of daily commute problems for the citizens of Lahore. With major national concerns like healthcare and education taking the backseat, it is important to weigh the advantage gained by these projects, and whether they were a necessity for the common Lahore citizens. With our study we aim to find out whether the budget spent on these projects has been worth it for the majority living in Lahore. We attempted to calculate the attitude of the common citizens towards these projects and whether they provided sufficient benefit in terms of commute time, mental and physical relaxation while traveling, and cost of commute. The quality of the route of everyday commute for students or employees is of major importance because it determines the freshness of the mind of the student or employee, and his/her performance at school or work. If these projects by the Government of Punjab prove to be successful in easing the strain of everyday commute, it can be concluded that the government has achieved a great deal by making citizens of Lahore more productive at work. This study also attempts to find out whether the citizens of Lahore (especially the younger generation) think that these projects were necessary or not. After the protest of Pakistanis over the demolishing of Kalma Chowk, the ongoing debate regarding demolishing Chowburji Chowk is also a part of this study as we aim to gather the common people’s opinion in this matter.

II. METHODOLOGY

A total of 202 responses were collected via online surveys and manually filled surveys; Google Docs was used to carry out the online survey, and the questionnaire was distributed through social media, email, university portals (mostly Kinnaird College for Women, FAST, and PU) and other online forums. Our target was to collect authentic information about travelling issues around Lahore, so we opted to get the questionnaire filled by individuals above 15 years of age, mostly students or employed individuals, so we could get a clear picture of their everyday commute problems. The questionnaire comprises of 25 questions and the questions asked the individuals about facts like their commute time, distance travelled, travel frequency per week, and the questions ask of the Government of Punjab.

III. HYPOTHESIS DEVELOPMENT

H0A: Majority of respondents own and avail private transportation
H1A: Yes, majority of respondents own and avail private transport in their daily commute.
H0B: The main route of the majority of respondents comprises of main roads
H1B: No, the majority of respondents do not travel via main roads.
H0C: Distance traveled by respondents is roughly 25 km
H1C: Distance traveled by respondents is roughly less than 25 km
H0D: New bridges and signal free routes reduced overall commute time for citizens of Lahore
H1D: Yes, New bridges and routes reduced overall commute time for citizens of Lahore.
H0C: Some of the routes were better before the construction of flyovers/underpasses
H1C: Yes, Some of the routes were better before the construction of flyovers/underpasses
H0D: The new infrastructural projects have reduced the congestion and blockage on city roads.
H1D: Yes, the new projects have reduced the congestion and blockage on city roads.
H0E: These projects are good for the growth of the city
H1E: No, These projects do not play a role in the growth of the city
H0F: The historical heritage of Lahore is at stake with the increasing construction work
H1F: Yes, the historical heritage of Lahore is at stake with the increasing construction work

IV. TESTING AND ANALYSIS OF HYPOTHESIS

<table>
<thead>
<tr>
<th>Hypothesis Surveyed</th>
<th>Value</th>
<th>Z- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0A: mode of the travelling is car</td>
<td>.52</td>
<td>.556 – 1.64</td>
</tr>
<tr>
<td>H1A: yes, mode of the travelling of the majority is car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H0B: The main route of the majority travels frequently is main roads</td>
<td>.69</td>
<td>5.76 – 1.67</td>
</tr>
<tr>
<td>H1B: The main route of the majority travels frequently is main roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H0C: Distance traveled by you daily is 25 km</td>
<td>.64</td>
<td>1.30 -1.64</td>
</tr>
<tr>
<td>H1C: Distance traveled by you daily is &lt; 25 km</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H0D: New bridges reduced overall commute time for citizens of Lahore</td>
<td>.60</td>
<td>2.835 -1.64</td>
</tr>
<tr>
<td>H1D: yes, Majority is agreed that new bridges reduced overall commute time for citizens of Lahore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H0E: Some of the routes were better before the construction of flyovers/underpasses</td>
<td>.48</td>
<td>3.07 – 1.64</td>
</tr>
<tr>
<td>H1E: No, Some of the routes were better before the construction of flyovers/underpasses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H0F: The historical heritage of Lahore is at stake with the increasing construction work</td>
<td>.48</td>
<td>1.10-1.64</td>
</tr>
<tr>
<td>H1F: Yes, The historical heritage of Lahore is at stake with the increasing construction work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case</td>
<td>H0</td>
<td>H1</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
<td>-----------</td>
</tr>
<tr>
<td>Mode of the travelling of the majority is car (majority = 50% or above)</td>
<td>µ = .50</td>
<td>µ ≠ .50</td>
</tr>
<tr>
<td>The main route of the majority comprises of main roads</td>
<td>µ = .50</td>
<td>µ ≤ .50</td>
</tr>
<tr>
<td>Distance traveled by you daily is 25 km</td>
<td>µ = .50</td>
<td>µ ≤ 25</td>
</tr>
<tr>
<td>New bridges reduced overall commute time for citizens of Lahore (less than 50% people think so)</td>
<td>µ = .50</td>
<td>µ ≤ .50</td>
</tr>
<tr>
<td>Some of the routes were better before the construction of flyovers/underpasses (less than 49% disagreed)</td>
<td>µ = .50</td>
<td>µ ≤ .50</td>
</tr>
<tr>
<td>The new projects have reduced the congestion and blockage on city roads. (less than 50% agreed)</td>
<td>µ = .50</td>
<td>µ ≤ .50</td>
</tr>
<tr>
<td>These projects are good for the growth of the city (less than 20% disagree)</td>
<td>µ = .50</td>
<td>µ ≤ .50</td>
</tr>
<tr>
<td>The historical heritage of Lahore is at stake with the increasing construction work (more than 40% agreed)</td>
<td>µ = .40</td>
<td>µ ≤ .40</td>
</tr>
</tbody>
</table>
V. ANALYSIS OF HYPOTHESIS

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Support</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hₐ:Accepted</td>
<td>Majority owns private transport</td>
<td></td>
</tr>
<tr>
<td>H₉:Rejected</td>
<td>The main route of the majority consists of main roads</td>
<td></td>
</tr>
<tr>
<td>H₉:Accepted</td>
<td>Distance traveled on a daily basis is roughly 25 km</td>
<td></td>
</tr>
<tr>
<td>H₈:Rejected</td>
<td>The new bridges and roads have reduced overall commute time for citizens of Lahore</td>
<td></td>
</tr>
<tr>
<td>H₇:Rejected</td>
<td>Some of the routes were better before the construction of flyovers/underpasses</td>
<td></td>
</tr>
<tr>
<td>H₆:Accepted</td>
<td>The historical heritage of Lahore is at stake with the increasing construction work</td>
<td></td>
</tr>
</tbody>
</table>

If we analyze our proposed hypotheses and their resulting outcomes, we find out that the majority of our respondents have access to private transportation, mainly a car or a bike. The distance traveled by our respondents daily also does not exceed 25 km, which means that the majority does not have to go across the city for their university or work. The majority also does not follow only main roads, and a large proportion of the route comprises of secondary roads. Given these facts, we see that our respondents were still not satisfied that the new developments have reduced their overall commute time; H₉ is rejected because the majority disagrees that they have experienced any increase in comfort whilst travelling after the Government of Punjab has spent trillions on the construction of new roads and bridges. It must be mentioned here that the responses of individuals who did not own a private vehicle and traveled via public transport were also recorded and they claimed to experience discomfort and inconvenience. The majority of respondents have also claimed that the increasing construction projects are a threat to the historical heritage of the city of Lahore.

VI. RESULTS AND DISCUSSIONS

Figure 1: impact of new bridges

Figure 2: comparison of routes
VII. RESULTS AND DISCUSSIONS

17. This question aims to find out whether the new routes and bridges have become a source of comfort for the citizens. The majority agrees and states that travelling has become more comfortable due to the new routes. We can assume that a more systematically distributed traffic is the reason behind this change.

18. We perceived that some of the routes were actually not in such a dire need of destruction and reconstruction that cost the government in trillions. A large fraction of our respondents agreed with us in this regard.

19. Road congestion is a major concern of all big cities in Pakistan. A poor infrastructure, poorly implemented traffic rules, large number of public and private vehicles, and poorly implemented routes contribute to the problem of road congestion. Waiting for long periods in traffic jams is tiresome for the citizens of Lahore, and we supposed that the Government of Punjab had taken this initiative to cure the menace of road congestion.

20. The new projects have helped in reducing congestion on roads. The majority of respondents agree that travelling has become more comfortable due to the new routes. We can assume that a more systematically distributed traffic is the reason behind this change.

21. We perceived that some of the routes were actually not in such a dire need of destruction and reconstruction that cost the government in trillions. A large fraction of our respondents agreed with us in this regard.

22. Road congestion is a major concern of all big cities in Pakistan. A poor infrastructure, poorly implemented traffic rules, large number of public and private vehicles, and poorly implemented routes contribute to the problem of road congestion. Waiting for long periods in traffic jams is tiresome for the citizens of Lahore, and we supposed that the Government of Punjab had taken this initiative to cure the menace of road congestion.

23. The new projects have helped in reducing congestion on roads. The majority of respondents agree that travelling has become more comfortable due to the new routes. We can assume that a more systematically distributed traffic is the reason behind this change.

24. We perceived that some of the routes were actually not in such a dire need of destruction and reconstruction that cost the government in trillions. A large fraction of our respondents agreed with us in this regard.

25. Road congestion is a major concern of all big cities in Pakistan. A poor infrastructure, poorly implemented traffic rules, large number of public and private vehicles, and poorly implemented routes contribute to the problem of road congestion. Waiting for long periods in traffic jams is tiresome for the citizens of Lahore, and we supposed that the Government of Punjab had taken this initiative to cure the menace of road congestion.
congestion. However, not all respondents agree but the majority agrees that road congestion is not a problem for them anymore. This means that the new routes have been systematically designed and are of benefit to the citizens. 22/23. We targeted our respondents to find out whether they question the absence of infrastructural development in remote cities. Lately, only the roads and bridges of Lahore are flourishing and being accessorized with fancy public transport like the Orange Line train. The majority of our respondents believe that such developmental tasks are only useful in bigger cities. However, our respondents also believe that remote cities should not be altogether deprived of transportation projects.

24. The growth of a city refers to its popularity, overall outlook, and successfulness in providing a good lifestyle to its citizens. According to our respondents, construction of roads, bridges, and transportation projects are not as instrumental in the growth of Lahore as a city.

25. Lahore is a city rich in cultural heritage. Our motive behind this question was to find out whether the recently burning debate regarding the destruction of Chowburjichowk holds any importance for our responding individuals. Previously, the popular and historical KalmaChowk was also destructed for a construction project in the city. The majority answered in affirmation of the opinion that these projects are having a bad effect on the heritage and historical significance of Lahore.

VIII. CONCLUSION

This study aimed to provide a cost and benefit analysis of the recent infrastructural development done by the Government of the Punjab. The main projects highlighted in this study were the Metro bus, the Orange Line train, and the signal free Jail Road route. The fact that a budget of billions of dollars is allocated to a single project prompts the question that whether the citizens of Lahore deem these projects necessary and useful. This study can be used for long term planning of infrastructure and development using the feedback of the common people residing in the city. Feedback is taken in the form of level of respondents’ satisfaction and whether their time and quality of commute has improved. This study also adds light to the debate regarding impact on Lahore’s historical heritage.

Suggestions:
1. The high budget used by the Government in Punjab must be justified by either systematic control of traffic with these new project designs or by taking transport initiatives where it is severely required.
2. The historical heritage of Lahore is depicted by the buildings, roads, and gardens, and it must be protected because they are assets of our nation. The recent project of Orange Line train has been rumored to require tearing down of the ChowburjiChowk, and not so long ago the KalmaChowk was also torn down.
3. The ongoing construction projects have given rise to many physical and psychological problems for those travelling on the affected routes daily. Stress, physical strain, heat strokes, depression, and inability to perform at work are some troubles faced by the affected citizens. Cure and precaution for these troubles must be provided by the government and interactive sessions and workshops should be arranged in order to educate and facilitate the citizens.

IX. RECOMMENDATIONS

This research paper aims to carry out a cost and benefit analysis of the recent infrastructural development undertaken by the Government of Punjab. The construction of new routes, new roads, the signal free Jail Road project, the Metro Bus project, and the Orange Line Metro project were the main subject of this study. According to the survey conducted and the hypothesis testing carried out, it can be concluded that majority of the citizens of Lahore still feel slightly stressed while travelling to their respective schools, universities, or workplaces. This can be a result of the interruptions caused by ongoing construction projects, the harsh weather, or the mismanagement of traffic flow. A vast majority of our respondents also agreed that some of the routes were better off before the construction of new roads, bridges, and transportation projects. A major worry outlined by the study was that the historical heritage of Lahore is under threat due to these construction projects. On the brighter side, this study concludes that the new routes developed by the government have reduced the commute time for most respondents, and the new development has increased the overall quality of the travel experience despite not eliminating all negative factors. It was also found that the majority claims that new projects have reduced congestion and blockage on roads.

REFERENCES


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Third Author – Tayyaba Khalil, MPhil (CS), Kinnaird College for Women, Lahore

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A hybrid approach for Sarcasm Detection of Social Media Data

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Abstract: In the course of the most recent couple of decades, Social networking and micro blogging websites such as twitter has allowed people to encounter in utilizing online assets. Twitter is rapidly gaining popularity as they allow the users to express and also share their opinions about certain related topics, which have been a mode for discussion with different communities, and messages are being posted across the world via this Social networking medium. A great deal of improvements has been observed in the field of sentimental analysis of twitter data. This project focuses mainly on sarcasm detection which is major part of sentiment analysis of twitter data which is helpful to analyze the sarcasm in the tweets where views are miscellaneous and highly unstructured, or may be positive, negative, sarcastic, ironic or neutral in some cases. This research work borrows the ideas of utilizing different semi-supervised algorithms like Lexical Analysis with N-grams approach, Knowledge extraction, contrast approach, emoticon based approach and hyperbole approach to propose a new rule based Hybrid approach for sarcasm detection.

Keywords: Hashtag Approach, Contrast Approach, Bigrams – N-grams Approach, Hyperbole Approach, Emoticon based, Hierarchical Approach

I. INTRODUCTION

The process of converting a sequence of characters into tokens is called Lexical Analysis. In a tweet, where there are 140 characters which are parsed by a lexical analyzer there are numerous tokens created. These tokens allows the machine to know, learn and predict whether the tweet is sarcastic or not with various features. The tweet characters given as input is parsed with the lexical analyzer and utilized to give tokens as our output. The probabilities of a tweet being sarcastic in the given tokens are analyzed in order to compute. This process is iterated over various tokens. Then the created tokens, coordinates with the tokens having few phrases in dictionary and later passed to the algorithm.

Twitter has many components such as "hashtag" and “mentions” which are considered as a type of metadata components. Hashtags are the frequently used metadata component which makes it possible to get set of messages a user can search for the tweet containing “hashtags” from various groups’ messages. A hashtag are/is associated with a particular medium and in the same manner does not allow be connecting and associating with pictures or messages from various stages. It is also observed that over 90% of the users use hashtags in their tweets. Hence, analyzing tweets based on hashtags can help us determine the result of our outcomes. “Sarcasm” can be utilized as a pursuit parameter, which may help us to obtain tweets with a slight possibility of having sarcasm in them. In such cases the user explicitly tries to hint use of sarcasm in a tweet. However, some users on twitter utilize “#sarcasm” not as a random hashtag but as a part of a sentence, which tells that every tweet having #sarcasm is not considered to be sarcastic. Hence, the algorithm assures that it doesn't assume every one of tweets with “#sarcasm” as sarcastic. Rather, it identifies the use of “#sarcasm” in a tweet, as either a hashtag or as a part of the sentence. In the latter case, the tweet is considered to be something about sarcasm but it is not classified as being sarcastic.

The algorithm checks whether there exists a token “#sarcasm”. If the token is available as a part of the sentence, it cannot be declared that tweet is sarcastic. Hence, the tweet listed into Non sarcastic list.

E.g. every #sarcasm is not considered as #sarcasm. – Non Sarcastic

On the other hand if the component does not exists as a part of the tweet it’s considered to be sarcastic if there exists at least three words with meaningful sentences.

E.g. the food was really great yummyyyyy. #sarcasm– Sarcastic

The algorithm observes that #sarcasm is at the end of the sentence and hence can deduce that the user intentionally was attempting to say that the tweet is sarcastic. Many researches showed that the Tweets contain some regularly used phrases/words which hints the probability of sarcasm in a sentence. While utilizing administered learning to build the knowledge base, if a considerate number of tweets utilize a specific phrase, the observed phrase is set apart of the new trained data set assumed to have knowledge of sarcasm, analyser adds it to the knowledge base. While parsing, when it is observed that any of these words are utilized as a part of given tweet, that tweet can be assumed as sarcastic which is proved in this case study by utilising lexical approach as part of machine learning approach. Finally, this becomes our first rule in rule based approach. Hashtag based approach is very essential and initial step to the new rule based engine that we have developed. The latter rules proves that sarcasm can also be detected without “#sarcasm” tags using combinational approaches involving POS logic [4], emoticons [3] etc. There are 7 rules or phases in a rule based approach and are as follows:

1) Hash tag based approach
2) Contrast approach
3) Lexicon based approach (N-grams=Bigrams)
4) Emoticon based approach
5) Hyperbole approach
6) Hierarchical approach
7) Hybrid approach

The Contrast approach uses a logic i.e. a tweet having a positive sentiment and negative situations is considered to be sarcastic and are marked as sarcastic. On the other hand, Lexicon based approach consists of bag of words and trained dataset to determine sarcasm in a tweet text. Since the twitter platform allows the user to use emoji to express their sentiments, hence a rule can be built based on the given feature. Emoticon based approach is used to determine text based on a logic having a positive sentiment tweet with negative emoticons and negative sentiment tweets with positive emoticon can be assumed to be sarcastic. In many instances, when the machine determines the emoticon logic it is automatically tagged as tweet and we move on to the next phase. The next phase in rule based engine is Hyperbole approach which can be considered the most convenient and important phase for sarcasm detection. It is based on a logic where we consider a unigram set of trained dataset with pragmatic markers solution is able to determine the sarcasm in a text. Unigram dataset contains set of intensifiers (’wow’, ‘Awesome’, ‘nottttt’) which expresses the emotions as exaggerations (as intensifiers) of a user. And the pragmatic markers are a way expressing words by representing them with various font styles (as [WRITING IN SQUARE BRACKETS] or “WRITING IN CAPITAL LETTERS” or use of “Exclamatory!!!!!!!!! FULLSTOPS………… /delimiters” etc...). Hence a proper solution is built using the above logic and we were able to determine sarcasm in texts more often. 6th rule of rule based approach is hierarchical approach which determines text as sarcastic through a sequential logic which takes into considerations.

Finally comes the main phase i.e. hybrid approach it’s a combinational logic of all the given approaches as shown in fig 1, which gives a high precise rate of sarcasm in a text and it was shown that it gave wonderful results compared to all the other approaches. Hence we were able to determine 75% of tweets to be sarcastic and 20% non-sarcastic and rest of the tweets were ignored as they were not marked under any rule based phases (which suggests that it might have been an empty tweet (after filtering process)).

![diagram](image)

**Figure 1:** Rule based approach

II. RELATED WORK

There have been many efforts seen in social media analysis on trying to understand the community cohesion, opinion analysis, marketing strategies, etc. There have been seen many different proposals made on-the-fly for social media sentiment analysis, such as Prometheus in [7] andTruthy in [8]. A “P2P” service called “Prometheus” is used, that uses multiple sources to collect and manage social information in order to apply social inference functions, while on the other hand “Truthy” is a web service used for tracking political memes in Twitter and helps to detect various misinformed content in the various contexts such as U.S. political elections etc.

Feature based classification approach or FBCA in [9] is considered the most suitable approach for sentiment analysis on twitter data, mainly reason being that the Keyword based approach cannot be ported to other languages which is a big disadvantage as tweets are tweeted in a multilingual form expressed as one, hence it was shown that FBCA got more accurate and adequate results compare to keywords based approach.

For over a large corpus of data, the features were represented through a “bag of words” model which generated a sparse matrix by utilizing a weighing scheme, this was achieved by limiting the results to a minimum of three characters word length. The case study [17] showed that by applying tokenization, removing stop words and by converting the words to lower case functions only individual word features were obtained. To overcome the following flaw a new feature was then introduce that represented as “bag of words” model which utilized the weighing scheme to generate a sparse matrix, by limiting the result to a minimum word length of three characters (words < 3). Later by evaluating this method, we found that the accurate result depends on several factors and is beyond the scope of this work.

Various lexicon-based sentiment analysis and classification methods are widely used in case studies [12], [13] and [14]. Gonçalves et al. conducted many researches to find out which method worked most effectively for sentimental analysis by comparing various existing lexicon-based methods. A broad overview of all existing works is shown in [10]. Our work is related to but different from the work in [11] which relates to the problem of generating feature-based summaries on reviews of a customer.

In [16], Go et al. was responsible for the proposal of the most advanced state of art researches in the field of twitter sentiment analysis field. Which explored the possibility of training data with a combinational logic of both Part of speech Tags (POS) having valence values with various n-grams features for the feature result set? A new parsing model was developed as a framework to implement combinational logic of different N-grams such as unigrams origrams, unigrams and bigrams, and unigrams and POS tags to detect the sentiments of tweets. Emoticons such as “:-), :/,” :-,(, :-p” which determined the positivity and negativity emotion in text were used to collect training data using twitter API.

The most effective and widely used method for sentimental analysis is based on supervised learning model because it is essential for an information to be known by the developer rather than letting the machine alone learn and deduce, for which the user has no knowledge on what basis the algorithm analyses. Conditional Random Fields (CRF) is used in [8] to extract targets by learning the patterns. A set of domain independent features such as syntactic dependency and parts of speech tags are used to
train CRF from multiple domains. It was observed that other learning methods can also be used.

A contextualized approach was shown in [18] for sarcasm detection. This made use of rigorous analysis of twitter data for sarcasm detection. This paper followed tenfold featured rule which proved to be some of the advanced technique for context approach. Some of the features were word unigrams, POS, Brown cluster Unigrams, pronunciation features and so on.

III. DATA

Recent works showed that, Sarcasm detection on Twitter found very less percentage of human annotators who were able to judge the sarcasm of others’ tweets. Later it was seen that the recent research exploits the users’ self-declarations feature for hinting sarcasm in the form of a metadata component #sarcasm or #sarcastic tags in their own tweet. We were able to find out the design choice which was able to capture common properties of sarcasm expressed without an explicit hashtag, but does not mean its’ always sarcastic.

The case study exploits the user’s self-reporting of sarcasm feature and follow the same methodology, by identifying all the tweets mentioning #sarcasm or #sarcastic in the #tag tweets from 2013–16 regardless of who the author is, and we were able to collect the most recent 2000 tweets of those authors. The tweets are collected from Node-xl. First we preprocess the given tweets by checking for all unwanted dependencies such as misspelled words, remove retweets, @mentions, remove hyperlinks, links, email and separate the words from the pragmatic markers and produce a fresh set of tweets to python machine to yield highly positive and precise results.

This process is entirely done by the parser.

This yields a sarcastic training set of 2500 tweets, for non-sarcastic data, we select an equal number of tweets from users over the same time period who have not mentioned #sarcasm or #sarcastic in their messages. The total dataset is evenly balanced at 3000 tweets. Since the hashtags #sarcasm and #sarcastic and #not are used to define the sarcastic examples, we remove those tags from all tweets for the prediction task.

IV. IMPLEMENTATION

4.1. Rule 1: Hashtag Approach

Hash tag approach:

We have created a unique dataset dictionary for hashtags and represented them as unigram set of words. The most widely used unigram hashtags for sarcastic comments are #Not, #sarcasm, #sarcastic etc.

A program logic as shown in fig. 2 is developed to identify these unique tags and make a comparison test to benefit our research for accurate results and classification of tweet data as sarcastic or not.

Input: Processed ‘Tweets’

Logic:
From tweetdict import tweets:
For each tweet in tweets:
    For data in tweet:
        If data == '#Sarcasm-Data':
            Append ‘Sarcastic’ to [Output-list]
        Else:
            Append ‘Non-Sarcastic’ to [Output-list]

For listdata in Output-list:
    Newlst=Join (tweet with list-data)
Output: [Newlist] of tweets

Figure 2: Hash tag Approach

4.2. Rule 2: Contrast Approach

Rule2:

Previous works have proved that parts of speech information is amongst the most informative and productive approach for this task.

We have applied the POS tagger and respective valence value from Warner et al. (2013) Dataset which includes features based on the absolute count and ratio of each tweet, along with the “lexical density” of the tweet, which models the ratio of nouns, verbs, adjectives and adverbs to all words a baseline capacitor (General Dictionary) is developed and implemented for productive analysis and classified data as shown in fig 3

Input: Processed ‘Tweets’
Logic:
From tweet-dict import tweet
From Pos-dictionary import All-pos
For each tweet in tweets:
    For data in tweet:
        #Contrasting Approach
        If data is found in Positive-verb-box and negative-situation:
            Append ‘Sarcastic’ to [Output list]:
        Else:
            Append ‘Non-Sarcastic’ to [Output list]
For tweet in tweets:
    For listdata in list:
        Newlist=Join(tweet with Output-List)
Output: [Newlist] of tweets

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4.3. Rule 3: Bigrams – N-grams Approach

N-gram Approach:
Patterns can be created by concatenating adjacent tokens into n-grams where n is the max value on which all possible combinations can be made for a single pattern. In other words, here n is equal to one hence called as unigram. An example of how the n-grams are constructed is explained with the example sentence: “Jack likes his new backpack”, by using n-grams it may be possible to capture how a word N-grams sequence:

<table>
<thead>
<tr>
<th>N-gram Sequence Length</th>
<th>N-gram Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-gram: “jill”, “likes”, “her”, “new”, “shades”</td>
<td>5</td>
</tr>
<tr>
<td>2-gram: “jill likes”, “likes her”, “her new”, “new shades”</td>
<td>4</td>
</tr>
<tr>
<td>3-gram: “jill likes her”, “likes her new”, “her new shades”</td>
<td>3.</td>
</tr>
</tbody>
</table>

All tend to appear in text with respect to other words. Usually n-grams are never longer than n = 3. Greater values are likely to create too many complex patterns that rarely match. In Fig 4, the N-gram process is being checked for all bigram values and marked as sarcastic or non-sarcastic.

Input: Processed ‘Tweets’

Logic:
From tweet-dict import tweet
From Pos-dictionary import All-Pos
From Bi-gram import ngram-dict

For each tweet in tweets:
    For data in tweet:
        #Ngram Algorithm
        If Bigram-data is found in bigram-dict:
            Append ‘Sarcastic’ to [Output-list];
            Else:
                Append ‘Non-Sarcastic’ to [Output-list];
        For tweet in tweets:
            For listdata in list:
                Newlist Join (tweet with Output-List)
Output: [Newlist] of tweets

4.4 Rule 4: Hyperbole Approach

Hyperbole Approach:
Kreuz and Roberts 1995 theoretical work has stressed the importance of hyperbole for sarcasm, we have implemented indicator logic for whether the tweet contains a word in a list of intensifiers (so, too, very, really), stretched words (righttti), capitalized words ([HELLO]), punctuations and so on. Hence giving us a more stable classifier hence covering most of the uncovered area for text classification as shown Fig 5 and analysis.

Input: Processed ‘Tweets’

Logic:
From tweets import tweet:
From unigram import ngram_dct:
For each tweet in tweets:
    fordata in tweet:
        #Ngram Algorithm
        If unigram-data is found in {unigram-dict}:
            Increment count1 by 1
        If punctuation-data is found in {punctuation-dict}:
            Increment count2 by 1
        If count1, count2 [Greater than] fixedvalue:
            Append ‘Sarcastic’ to [Output-list]
            Else:
                Append ‘Non-Sarcastic’ to [Output-list];
        For tweet in tweets:
            For listdata in list:
                Newlist Join (tweet with Output-List)
Output: [Newlist] of tweets
4.5. Rule 5: Emoticon based

*Emoticon Based:* We have developed a dictionary containing the Unicode values for all available emoticons and we use the positive-verb dictionary from “posdict” and assuming that a tweet having a positive sentiment followed by a negative sentiment emoticon is said to be sarcastic based on this theory we are mark and divide the tweets as sarcastic and non-sarcastic as shown in fig 6

The most commonly used emoticon to comment a sarcastic message in twitter or any social media is upside-down emoticon and it’s been logically proved.

**Input:** Processed ‘Tweets’

**Logic:**

```
Input: Processed 'Tweets'
Logic:
From tweets import tweet
From posdata import all_dict
From emoji import emoji_dict
For each tweet in tweets:
  #postagging, emoticonTagging
  For data in tweets:
    #for emoticon, hyperbole,n-gram and contrast approach
    If everyrule(data) == 'sarcastic'
      Append 'Sarcastic' to [Output-list]:
    Else:
      Append 'Non-Sarcastic' to [Output-list]:
    For tweet in tweets:
      For listdata in list:
      Newlist Join (tweet with Output-List)
Output: [Newlist] of tweets
```

**Figure 6:** Emoticon based approach

<table>
<thead>
<tr>
<th>Tweets</th>
<th>Contrast</th>
<th>Lexicon</th>
<th>Emoticon</th>
<th>Hyperbole</th>
<th>Hierarchical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tweet1</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Sarcastic</td>
<td>Sarcastic</td>
</tr>
<tr>
<td>Tweet2</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Sarcastic</td>
</tr>
<tr>
<td>Tweet3</td>
<td>Non-Sarcastic</td>
<td>Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Sarcastic</td>
</tr>
</tbody>
</table>

4.6. Rule 6: Hierarchical Approach

*Hybrid Based:* The sixth rule in the rule based approach is hierarchical approach. It’s a sequential logic of all the above approaches (refer to figure 6). The tweets are marked as sarcastic if it’s found true in anyone of the rule except for in hashtag rule (Since #tag rule tags all tweets as sarcastic) the implementation is simplified using hierarchical directory format and shown in the figure 7

**Input:** Processed ‘Tweets’

**Logic:**

```
Input: Processed 'Tweets'
Logic:
For every-rule in Allrules:
  Import tweets
  For tweets import tweet
  For each tweet in tweets:
    #for emoticon, hyperbole,n-gram and contrast approach
      If everyrule(data) == 'sarcastic':
        Append 'Sarcastic' to [Output-list]:
      Else:
        Append 'Non-Sarcastic' to [Output-list]:
    For tweet in tweets:
      For listdata in list:
      Newlist Join (tweet with Output-List)
Output: [Newlist] of tweets
```

**Figure 7:** Hierarchical Approach

**Hierarchical Plotting table:** If the tweets are marked as sarcastic for a sequential logic of contrast with lexicon, hyperbole and emoticon approaches. Then tweet is automatically considered as sarcastic and tagged under hierarchical rule as shown in fig 8.
4.7. Rule 7: Hybrid Approach

**Hybrid Based:**
The final rule in the rule based approach is hybrid approach. It’s a combinational logic of all the above approaches (refer to figure 7). The tweets are marked as sarcastic if it’s found true in anyone of the rule except for in hashtag rule (Since #tag rule tags all tweets as sarcastic) the implementation is simplified into hybrid directory format and shown in the figure 9.

**Input:** Processed ‘Tweets’

**Logic:**
For every-rule tweet in Allrules:
    Import tweets
    From tweets import tweet
For each tweet in tweets:
    For data in tweets:
        For emoticon, contrast, n-gram and hyperbole approach
            If two rules (data) == ‘sarcastic’:
                Append ‘Sarcastic’ to [Output-list]:
            Else:
                Append ‘Non-Sarcastic’ to [Output-list]:
    For tweet in tweets:
        For listdata in list:
            Newlist Join (tweet with Output-List)

**Output:** /Newlist/ of tweets

**Figure 8:** Hierarchical plotting table

<table>
<thead>
<tr>
<th>Tweet</th>
<th>Sarcastic</th>
<th>Non-Sarcastic</th>
<th>Non-Sarcastic</th>
<th>Non-Sarcastic</th>
<th>Sarcastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tweet1</td>
<td>Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Sarcastic</td>
</tr>
<tr>
<td>Tweet2</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
</tr>
<tr>
<td>Tweet3</td>
<td>Non-Sarcastic</td>
<td>Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
</tr>
<tr>
<td>Tweet4</td>
<td>Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
<td>Non-Sarcastic</td>
</tr>
</tbody>
</table>

**Figure 9:** Hybrid Approach

**Hybrid Plotting table:** Tweets are marked as sarcastic for a combinational logic for either contrast with hyperbole, or contrast with lexicon, or lexicon with hyperbole, or lexicon with emoticon or contrast with emoticon and emoticon with hyperbole then tweet is automatically considered as sarcastic and tagged under hybrid rule as shown in fig 10.
The output of rule based approach is a list of tweets marked either sarcastic or non-sarcastic for every rule in a rule engine and each result were saved by their rules name respectively as “.csv” files and charts were produced automatically by python and plotly [3]. In figure 8 a comparative analysis has been shown for the Rule based approach. And proving that hybrid approach yields a better result compare to other approaches. The Rule based approach was able to detect sarcasm in text over 80% at precision rate which proved that it was giving 3% more accurate results compare to the existing algorithm [10] in few test runs. Test runs for all the features in rule engine is represented through charts as shown in fig 11, fig 12, fig 13, fig 14, fig 15, fig 16, fig 17 and fig 18 Fig. 3.6.1 displays a comparative analysis chart of all the rules in our rule based approach. Fig. 3.6.2 states about contrast approach this is one of the upper layer rule which is based on features such as POS tags and found that over 40% of the time tweets written comes under this category. Fig. 13 tells about the emoticon rules as observed not everyone uses emoticons all the time and the results had a very less complexity and time while parsing this phase but it did play a vital role in hybrid and hierarchical approach. Fig. 3.6.4 shows the results of hash tag rule which is considered to be by default rule results contains tweets as sarcastic and non-sarcastic if there exists “#sarcasm”. Fig. 3.6.5 and Fig.3.6.6 shows results of lexicon and hyperbole approaches respectively. Fig. 3.6.7 and Fig. 3.6.8 shows the results of combinational logic and sequential logic of hybrid and hierarchical approach. From all the results after working over three different sets of sarcastic set of tweets we come to a conclusion that the contrast approach, lexicon, hyperbole and hybrid approaches are considered to be the higher level approach to give accurate and precise results hence deducing a better prediction rule compare to previous work.
Figure 12: Contrast Approach

Figure 13: Emoticon Approach

Figure 14: Hashtag Approach

Figure 15: Lexicon Approach
Sarcasm detection on twitter tweets is more complicated as it provides very less detailed results, and developing a dictionary for these kind of text documents takes more time and resources. Social media posts are hard to analyze on the phrase or sentence level because of theirs unique structure and grammar. Since twitter allows user to enter 140 characters processing time also increases. The sarcasm detection was ignored for different languages (except English), repeated tweets and empty or a single letter/word tweets. The future work will be focused on backtracking of tweets (analyzed based on user’s past replies and comments) and multilingual language support.

VI. CONCLUSION

REFERENCES


[3] Plotly.blogspot.org


[17] Harunalsah, Paul Trundle, Daniel Neagu “Social Media Analysis for Product Safety using Text Mining and Sentiment Analysis”
Sentiment Analysis of Twitter Data using Naïve Bayes with Unigram Approach

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Abstract: Sentiment analysis has emerged as a widespread and effective technique for opinion mining of web data analysis. The development of the user-generated content has opened new prospects for research in the field of sentiment analysis. This paper analysis a model for sentiment analysis of twitter tweets using Unigram approach of Naïve Bayes. Firstly, tweets need to be downloaded using a free version tool called NodeXL. Once that is done Data pre-processing schemes are applied on the dataset. Secondly, the corpus needs to be trained. Thirdly, the behavior of Naive Bayes is studied in combination with different tweet topics to obtain the results for sentiment analysis.

Keywords: Naïve Bayes classifier, Holdout method, K-fold cross validation, Leave-one-out cross validation

I. INTRODUCTION

Based on Bayes Theorem with hypothesis independent among analyst, the Naïve Bayes classification method comes into picture. In simple language, a Naïve Bayes classifier assumes the presence of a particular article in a class is unrelated to the existence of any other feature. Take for example, a fruit may be considered amango if it is yellow, spherical, and has 2.5 inches of diameter. Assuming that the features depend alongside each other or the existence of the other additional features, all of these individually contributes to the probability that the fruit is a mango and hence the term used is ‘ naïve’.

The model of Naïve Bayes is very easy to build and comes very much in handy while using or working with large data sets. It's known for its simplicity. Being the simplest among the sophisticated methods of classification. It provides a way of analyzing algorithms, it's known to outperform even with highly sophisticated methods of classification. It provides a way of classifying and calculating the subsequent probability [14] \[
P(c|x) = \frac{p(x|c)p(c)}{p(x)}
\] (1)

\[
P(x) = \text{Probability of predictor given class.}
\]

\[
P(c|x) = \text{Subsequent probability of class (c, target) given predictor (x, attributes)}.
\]

\[
P(c) = \text{Prior probability of class}.
\]

\[
P(x|c) = \text{Possibility, which remains the probability of predictor given class}.
\]

\[
P(x) = \text{Formal probability of predictor}.
\]

Cross Validations

Cross validations, based on the principles of testing the algorithm on a new dataset yields a better estimate of its performance. The samples used for training are split into validation samples and training samples. The training samples are used to train the algorithm and the validation samples is used as new data to evaluate the performance and working of the algorithm.

Holdout Method

One of the simplest type of validation where the dataset is split into two sets, i.e. the training set and the validation set. The algorithm is trained using the training set only. The algorithm using the validation set then evaluates data. The evaluation can have a high variance as the evaluation may depend solely on the data that is present in the training set.

K-Fold Cross Validation

K-fold cross validation acts as an improvement of the hideout method. The dataset is repeated k times and divided into k subsets in k-fold cross validation method. In each instance only one of the k sets are used and the remaining k-1 sets are put together to form the training set. The errors across all the trails are then averaged. The disadvantage of K-fold cross validation method is that it takes k times more computational time than because the algorithm is meant to run k times.

Leave-One-Out Cross Validation

The extremely logical forms of k-fold cross validation where k equals the number of data points. The training on the algorithm is done on all data points except for one. It terms to be computationally expensive.

II. LITERATURE SURVEY

It was during the early 1990’s that the research was started in the field of sentiment analysis. The term sentiment analysis along with opinion mining was first introduced during the year 2003, during this time the work was very much limited only to subjective detection, sentiment adjectives and interpretation of...
metaphors. J.M. Weibe [5] was a research scholar who tried to present an algorithm that was able to identify subjective characters in fictional narrative text based on regularities in the text. M.A.Hearst [6] was another research scholar that had come up with intelligent text based systems to refine the information access task, while J.M. Weibe [5] was undergoing extensive examinations to try to find out if the naturally occurring narratives and regularities with the writings of the authors and come up with an algorithm that would track the point of view on the basis of these regularities.

Another experimental system came into picture, it was called PHOAKS, which was abbreviated as people helping one another to know stuff by L.Terveen [2], this would help users to find the information on the web. This system was known to be using a combined filtering approach to recognize and reuse recommendations.

A browsing method using virtual reviewers for the combined exploration of movie reviews from various viewpoints. Was developed by J.Tatemura. Morinaga et al presented a framework for mining product reputation over the internet, by working in the field of marketing and customer relationship management. This approach that was defined would collect the opinions from the users automatically from the internet and text mining techniques were to obtain the reputation of the product in the market.

An unsupervised method presented by P.D. Turney[1] was used to classify the reviews using a system of thumbs up and down, which would mean thumbs up for recommended and thumbs down for not recommended. It used PMI i.e. point wise mutual Information and document level classification of sentiments to get the average semantic orientation of reviews. The accuracy rate that was obtained was 74%for about 410 reviews. In some time, Turney along with Littman tried to expand their work by presenting an approach that would find the semantic orientation of a text by calculating its statistical association by using a set of positive and negative words using LSA i.e. Latent Semantic Analysis and PMI. This method was tested with 3596 words, which included a combination of 1614 positive words and 1984 negative words and had obtained an accuracy rate of 82%.

Using Standard machine learning techniques a document level sentiment classification was performed by Pang et al[3]. He along with his group mates used Maximum Entropy, naive bayes and SVM techniques to find results for unigram and bigrams and got an accuracy rate of 82.9% using three fold cross validation for unigrams. The work that they were doing also focused on better understanding of the problems and the difficulties within the sentiment classification task. A classifier was trained using reviews from the major websites by Dave et al[8]. He got a result that showed that the higher order grams can provide better results than unigrams.

M.Rushdi et al [4] discovered the sentiment analysis chore by applying SVM for testing variety of domains of dataset using various weighing schemes. They used three corpora for the experimentation including a new corpus that was introduced by them and performed 10-fold as well as 3-fold cross validation for each corpus.

A holistic approach that would infer the semantic orientation of an opinion word that would be based on review context and would combine multiple opinions was proposed by Ding et al[7]. It took into account implicit opinions and handles implicit features that were represented by feature indicators.

Study of sentiments in comparative sentences and web context based sentiments was proposed by Murthy G. and Bing Liu [8]

V Suresh et al [9] presented an approach that used stop words and gaps between stop words as the feature for sentiment analysis.

Algorithm

Given below is the Naïve Bayes classifier. Capital letters depict variables and values are denoted using lower case. Bold characters are used to depict set of variables.

\[ X = \{X_1 \ldots X_n\} \]
\[ \Omega = D_1 \times \ldots \times D_n \]
\[ c \in \{0, \ldots, -1\} \]
\[ \text{Unobserved random variable denoting the class of a set of features.} \]

\[ h(x), c = 0, \ldots, u - 1 \]
\[ \text{class } c \text{ is assigned a discriminant function} \]

\[ h(x) = \text{argmax}_{c \in \{0, \ldots, u-1\}} fc(x) \]
\[ \text{The classifier selects the class with the maximum discriminant function on a given set of variables} \]

\[ f(x) = P(C = c | X = x) \]
\[ \text{set of variables as the discriminant function} \]

Applying Bayes’ theorem from

\[ Eq. 1 \]
\[ P(c | X = x) = \frac{P(X = x | c) P(c)}{P(X = x)} \]
\[ \text{Since } P(X = x) \text{ is the same for all classes it can be ignored.} \]

\[ P(X = x | c) = \frac{P(X = x | c) P(c)}{P(X = x)} \text{ where } P(X = x | c) P(C = c) \text{ is called the class-conditional probability distribution (CPD).} \]

Thus the Bayes’ classifier written as in

\[ Eq. 2 \]
\[ h(x) = \text{argmax}_{c \in \{0, \ldots, u-1\}} fc(x) \]
\[ \text{Applying the assumption that features are independent given the class on Eq. 2, we can get the naive Bayes classifier.} \]

\[ f(x) = \prod_{j=1}^{n} P(X_j = x_j | c) P(C = c) \]

III. Dataset

Dataset1: #Achchedin

Achhe din aane waale hain [10] (English translation would mean that Good days are coming) was the Hindi slogan of the Indian political party - Bharatiya Janata Party (BJP) during 2014 Indian general parliamentary election. The statement was first used by
BJP’s Prime Ministerial candidate Mr. Narendra Modi, assuming that a flourishing future was in store for India if the BJP party would win and come into power. After the BJP’s victory in the election, including mentioning the words “achhe din” (which means good days) have been used both to express hopefulness and to criticize if anything goes wrong with the Modi government.

Eg. RT @Saloni_shines: What ?? Are petrol and diesel prices hiked again ? No Outrage.. No Media Coverage.. Come on.. #AchheDin

Number of Tweets: 3052 Tweets

**Dataset 2: #makeinindia**

The Prime Minister, Shri Narendra Modi, today launched the Make in India[11] initiative with an aim to give the Indian economy global recognition. Addressing a gathering consisting of top global CEOs at the event in Vigyan Bhawan in the capital, the Prime Minister said “FDI” should be understood as “First Develop India” along with “Foreign Direct Investment.” He urged investors not to look at India merely as a market, but instead see it as an opportunity.

Eg.RT @makeinindia: India records it’s highest ever year-on-year FDI inflows. There has never been a better time to #MakeInIndia. https://t.co/…

Number of Tweets: 3096 Tweets

**Dataset 3: #pampore**


Eg.RT @rajnathsingh: Congratulations to Army & Security Forces on successful operation at Pampore.Our forces are extremely capable to counter…

Number of Tweets: 2229 Tweets

**Dataset 4: #trumph**

Donald John Trump[12] (born June 14, 1946) is an American businessman, television producer, author, politician, and the Republican Party nominee for President

Eg.@cnn well the american should decide on 8 who is better to lead them to promise land. #trumph #clinton

Number of Tweets: 2159 Tweets

**Pseudocode**

START
Select cross validation method
Add Input file. Read
Cond1- Success Input ? YES/ NO
If YES , Is k-fold cross validation ? YES /NO
Cond1- if NO, Throw error message.
Goto step3
Cond2- If YES, create Training set and test set
Taken data from C.
If NO, divide dataset into k sets.
Data from C.
Calculate prior probabilities from training set
From B. Calculate conditional probabilities for features values in test data
Calculate posterior probabilities for each class
A-Classify. Display the result.
Cond3-is end of test set? YES /NO
If YES, Calculate Accuracy
If NO, goto STEP 11
Display Accuracy
Cond4- If k-fold cross validation ? YES / NO
If YES, Cond5- Is last set? YES / NO
Cond5- IF YES, END.
Cond5- IF NO, Goto STEP8
Cond4- If NO, END
STOP

**Figure 1: Proposed Framework for Sentiment Analysis using Naïve Bayes**
IV. SYSTEM DESIGN

Created as a desktop application using Microsoft visual Studio along with C# programming language and simple windows form, the naïve bayes classifier is designed for reading a dataset with data that has been categorized.

In order to be read correctly by the program, the following structure needs to be followed.

- The file that is given as input should be a .xls (Microsoft Excel File) or .csv file.
- The dataset should first contain the column of tweets and the next column of the tweeted date.
- The first column (tweets) can contain any type of data as long as it’s the tweet itself.
- The second column should only be of the type date.

The unigram approach is designed in such a way that it can run three cross validation methods:
1) Holdout method
2) K-fold cross validation
3) Leave-one-out cross validation

Naïve bayes system shown in the unigram approach is designed using windows forms, that reads an input file.xls containing the data set(tweets) according to users choice. Depending on the unigram approach method selected by the user, the input dataset is split into training set and test set.

The training set is then used to calculate the probabilities of each class. The conditional probabilities of each class are calculated using single instance from the test set. Posterior probabilities of each class are then calculated. This process is undergone on each instance of the dataset.

The number of correct classification is obtained which is then used to calculate the accuracy of the naïve Bayes classifier.

The workflow of naïve bayes system is shown above in the flowchart (Figure 1 & 2).

V. RESULTS OF NAÏVE BAYES

In Fig 3 we see the graphical results for the dataset achieved in using Naïve Bayes. The positive tweets were 49% for unigrams using naïve. On addition, the negative tweets were found to be 30% and the neutral tweets were found to be 20%. It is concluded that positive tweets prevail over the other two tweet rates.

Figure 3: Graphical Results for the dataset1 using Naïve Bayes

Figure 4: Graphical Results for the dataset2 using Naïve Bayes
**Figure 5:** Graphical Results for the dataset3 using Naïve Bayes

In Fig 5 we see the graphical results for the dataset trump using Naïve Bayes. The positive tweets were 54% for unigrams using naïve. On addition The negative tweets were found to be 23% and the neutral tweets were found to be 21%. It is concluded that positive tweets prevail over the other two tweet rates and the difference between neutral and negative was found to be only 2%.

**Figure 6:** Graphical Results for the dataset4 using Naïve Bayes

In Fig 6 we see the graphical results for the dataset make in India using Naïve Bayes. The positive tweets were 47% for unigrams using naïve. On addition The negative tweets were found to be 23% and the neutral tweets were found to be 29%. It is concluded that positive tweets prevail over the other two tweet rates.

**VI. CONCLUSION**

In this paper, we designed and developed a naïve Bayes classifier that was designed to read any data set with categorical data and a prescribed structure in the input excel file. The classifier was tested using four different data sets generated from node XL software using twitter API. The naïve Bayes methods were used to calculate the accuracy of the classifier. For all the data set, the positive, negative and neutral tweets were found. Also a time based analysis was done using line graph to check the day wise rating of the tweets.

It can be observed from this paper, that the results of the naïve Bayes classifier showed some results that were in general and with a lot of errors that were not been able to be handled by the Bayes algorithm.

**REFERENCES**


[10] en.wikipedia.org/wiki/Achhe_din_aane_waale_hain
[14] analyticsvidhya.com/blog/2015/09/naive-bayes-explained/
PAP SMEAR CYTOLOGICAL OUTCOMES IN HIV POSITIVE WOMEN REFERRED FOR VISUAL INSPECTION TESTS IN MURANG’A DISTRICT HOSPITAL, MURANG’A COUNTY, KENYA

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ABSTRACT

Background: Cervical cancers are some of the leading causes of deaths among women of reproductive age in the developing world and are commonly either diagnosed late or misdiagnosed. Abnormal cervical cytological results in HIV-positive women are much higher than what is found in the general population. Though Papanicolaou (Pap) smear is the gold standard in screening for cervical cancers, the method is not being used widely in the resource constrained countries. The methods that are currently being used are visual inspection with acetic acid (VIA) and visual inspection with Lugol’s iodine (VILI).

Broad objective: The objective of the study was to investigate Pap smear cytological outcomes in HIV positive women referred for visual inspection tests in Murang’a District Hospital.

Methods: In this comparative cross sectional study, 78 HIV positive women attending the reproductive health section of the CCC aged between 18 and 50 years were subjected to Pap smear VIA and VILI after consenting.

Results: The results showed majority of the HIV positive women (about 49%) were in monogamous marriage and about 24% were single and never married. The rest were either separated or widowed. Most respondents had less than 2 recent sexual partners. The positivity of Pap smear in this study was 11.5%. Socio demographic characteristics and Pap smear results were not correlated in the study population. The positivity of both VIA and VILI in this study was 3.8%. There was 100% concordance in results for VIA and VILI. There were more abnormalities detected on Pap smear than on VIA/VILI (11.5% vs. 3.8%). The degree of agreement between Pap smear and VIA/VILI was weak, with a kappa (k) of -0.061.

Conclusion: There were no respondents found to be in polygamous marriage. Pap smear detected more abnormalities than VIA/VILI. VIA/VILI shouldn’t replace Pap smear as the primary screening tool for universal screening in Murang’a District Hospital.

Index terms – Cervical Cancer; Murang’a District Hospital; Pap smear; VIA; VILI.

INTRODUCTION

The early detection and accurate diagnosis of cervical cancer is the key to the determination of its prevention, management and clinical outcomes. Nearly all cases of cervical cancer are caused by human papillomavirus (HPV), and only two high risk HPV types, 16 and 18, are responsible for about 70 percent of all cases of cervical cancers reported in the world (Watson, 2009). Incidences and mortalities related to cancer of the cervix are both decreasing in developed countries because of effective cytological analysis screening programs through Papanicolaou (Pap) smear (Haydaroglu, 2004). This is not possible in the developing countries because Pap smear screening is expensive; there is shortage of trained cytopathologists and also due to the fact that the test is accomplished in several stages (ACCP, 2002). These potential difficulties in cytology-based programs have led Kenyan health authorities to consider using other low-cost screening technologies like visual inspection with acetic acid (VIA) and Lugol’s iodine (VILI). These tests are however associated with false positives in non-cancerous lesions of the cervix hence predisposing these women into expensive cytotoxic chemotherapies. In cases of false negatives they can fail to detect cervical abnormalities leading to poor management of
disease. This study therefore aimed at generating data on the comparative effectiveness of VIA/VILI and Pap smear tests to establish the degree of agreement on the results between the two in the diagnosis of cervical cancer among human immunodeficiency virus (HIV) positive women attending Comprehensive Care Clinic in Murang’a district hospital since this data is generally lacking.

MATERIALS AND METHODS
This was a comparative cross sectional study carried out in the reproductive health section of the Comprehensive Care Centre (CCC) in Murang’a district hospital, the main referral hospital for the entire Murang’a County and its environs, Murang’a County, Kenya. A total of 78 HIV positive women aged between 18 and 50 years were recruited conveniently from the reproductive health section of the CCC. HIV infected women who declined to participate, were experiencing menstrual flow or had had hysterectomy were excluded from the study.

Ethical approval of the study protocol was obtained from Mount Kenya University Ethical Review Committee, NACOSTI and also from Murang’a district hospital. After taking an informed consent from all those within the eligibility criteria, cellular materials from the uterine cervix were collected using cytobrushes and spatulas. The materials were transferred onto glass microscope slides. The slides were fixed immediately in 70% alcohol. This was followed by VIA and VILI tests. The fixed slides were stained by Pap stain and examined microscopically in the Laboratory.

RESULTS

The study revealed that majority of the HIV positive women (about 49%) were married monogamous and about 24% were single never married. About 27% were either separated or widowed (Figure 1).

Table 1: Measures of central tendencies for age, number of children and age at menarche

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean Statistic</th>
<th>Std. Error</th>
<th>Std. Deviation</th>
<th>Variance</th>
</tr>
</thead>
</table>

Figure 1

The study revealed that majority of the HIV positive women (about 49%) were married monogamous and about 24% were single never married. About 27% were either separated or widowed (Figure 1).
Table 1 shows that the mean age of the respondents was 37.67 years (SD ±7.521) and this compared favorably with the modal age of 45 years and median age of 38 years. This showed the study population was normally distributed. The mean number of children was about 3 while the modal number of children was 2. In addition, the mean age of menarche was 14.56 years (SD ±1.5). Modal age of menarche was 15 years and the median age is about 14 years.

Table 2: Correlations between age in years and Pap smear results

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
<th>Pap smear results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>1</td>
<td>0.963</td>
<td>78</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Figure 2: Recent sexual partners

The study further revealed that most respondents (75.6%) had less than 2 recent sexual partners, while 21.8% of the respondents had between 2 to 4 recent sexual partners (Figure 2).

The Pap smear results reveal 11.5% positivity (Figure 2). This means that 11.5% (95% CI: 4.42% to 18.58%) of the respondents had a positive cervical cancer screening Pap smear results.

Of the positive cervical cancer screening Pap smear results about 67% were Low-grade squamous intraepithelial lesion (LSIL) while 33% were High-grade squamous intraepithelial lesion (HSIL).

The results demonstrate that respondents’ age in years and Pap smear results are not correlated in the study population. There was no statistical association between the number of recent sexual partners and the Pap smear results
Pearson’s product moment correlation coefficient shows a low positive linear relationship between the age in years and the Pap smear results ($r = 0.005$) that is not significantly different from Zero ($p=0.963$) (Table 2). The results demonstrate that respondents’ age in years and Pap smear results are not correlated in the study population.

**Table 3: Bivariable analysis between recent sexual partners and Pap smear results**

<table>
<thead>
<tr>
<th>Number of recent sexual partners</th>
<th>Pap Smear Results</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2 years</td>
<td>Negative</td>
<td>86.4% (51/59)</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
<td>13.6% (8/59)</td>
</tr>
<tr>
<td>&gt;2 years</td>
<td>Negative</td>
<td>94.7% (18/19)</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
<td>5.3% (1/19)</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>88.5% (69/78)</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
<td>11.5% (9/78)</td>
</tr>
</tbody>
</table>

Chi-square test for independence is used to test significance difference between the number of recent sexual partners and the Pap smear results. It revealed that there is no statistical association between the number of recent sexual partners and the Pap smear results (Table 3).

The VIA results reveal 3.8% positivity. This means that 3.8% of the respondents had a positive cervical cancer screening VIA results.

The VILI results reveal 3.8% positivity. This means that 3.8% of the respondents had a positive cervical cancer screening VILI results.

Pap smear test was taken as the gold standard for cervical cancer screening.

**Table 4: VIA cervical screening tests**

| VIA Results | Pap Smear Results | |
|-------------|-------------------| |
| Negative    | 66                | 9         |
| Positive    | 3                 | 0         |
|             | 69                | 9         |

Sensitivity = (0/9 * 100%) = 0.0%
Specificity = (66/69 * 100%) = 95.7%
This means the VIA screening test was very good at picking out the women who did not have cervical cancer (see specificity) but very poor at picking out women with cervical cancer (see sensitivity).

PPV = (0/3 * 100%) = 0.0%
NPV = (66/75 *100%) = 88.0%
This means that probability that subjects with a positive screening test truly have the disease is very low at 0.0% (see PPV) using the VIA screening test. The probability that subjects with a negative screening test truly don't have the disease is high at 88.0% (see NPV) using the VIA screening test.

**Table 5: VILI cervical screening tests**

| VILI Results | Pap Smear Results | |
|--------------|-------------------| |
| Negative     | 66                | 9         |
| Positive     | 3                 | 0         |
|             | 69                | 9         |

Sensitivity = (0/9 * 100%) = 0.0%
Specificity = (66/69 * 100%) = 95.7%
This means the VIA screening test was very good at picking out the women who did not have cervical cancer (see specificity) but very poor at picking out women with cervical cancer (see sensitivity).

PPV = (0/3 * 100%) = 0.0%
NPV = (66/75 *100%) = 88.0%
This means that probability that subjects with a positive screening test truly have the disease is very low at 0.0% (see PPV) using the VIA screening test. The probability that subjects with a negative screening test truly don't have the disease is high at 88.0% (see NPV) using the VIA screening test.
Sensitivity = \((0/9 \times 100\%) = 0.0\%\)
Specificity = \((66/69 \times 100\%) = 95.7\%\)

This means the VILI screening test was very good at picking out the women who did not have cervical cancer (see specificity) but very poor at picking out women with cervical cancer (see sensitivity).

\[
PPV = (0/3 \times 100\%) = 0.0\%
\]
\[
NPV = (66/75 \times 100\%) = 88.0\%
\]

This means that probability that subjects with a positive screening test truly have the disease is very low at 0.0\% (see PPV) using the VILI screening test. The probability that subjects with a negative screening test truly don't have the disease is high at 88.0\% (see NPV) using the VILI screening test.

**Table 6: Cross-tabulation between Pap smear and VIA results**

<table>
<thead>
<tr>
<th>VIA Results</th>
<th>Negative</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>66</td>
<td>9</td>
</tr>
<tr>
<td>Positive</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Of the 78 HIV positive women evaluated, 66 HIV positive women evaluated had negative cervical cancer test as agreed by both Pap smear and VIA results. In addition, both tests agreed that there were no HIV positive women had cervical cancer.

**Table 7: Symmetric measures**

<table>
<thead>
<tr>
<th>Measure of Agreement</th>
<th>Value</th>
<th>Asymp. Std. Error</th>
<th>Approx. T</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa</td>
<td>(-0.061)</td>
<td>0.028</td>
<td>(-0.638)</td>
<td>0.524</td>
</tr>
</tbody>
</table>

In the symmetric table, \(k = -0.061, p=0.524\) (Table 7). The observed level of agreement between the two tests was less than what would have been expected by chance and therefore the inter-rater reliability was unsatisfactory.

**Table 8: Cross-tabulation between Pap smear and VILI results**

<table>
<thead>
<tr>
<th>VILI Results</th>
<th>Negative</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>66</td>
<td>9</td>
</tr>
<tr>
<td>Positive</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Of the 78 HIV positive women evaluated, 66 HIV positive women evaluated had negative cervical cancer test as agreed by both Pap smear and VIA results. In addition, both tests agreed that there were no HIV positive women had cervical cancer.

**Table 9: Symmetric Measures**

<table>
<thead>
<tr>
<th>Measure of Agreement</th>
<th>Value</th>
<th>Asymp. Std. Error</th>
<th>Approx. T</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa</td>
<td>(-0.061)</td>
<td>0.028</td>
<td>(-0.638)</td>
<td>0.524</td>
</tr>
</tbody>
</table>

N of Valid Cases 78
In the symmetric table, k = -0.061, p=0.524 (Table 9). The observed level of agreement between the two tests was less than what would have been expected by chance and therefore the inter-rater reliability was unsatisfactory.

**Table 10: Cross-tabulation between VILI and VIA results**

<table>
<thead>
<tr>
<th>VIA Results</th>
<th>Negative</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>VILI Results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>75</td>
<td>0</td>
</tr>
<tr>
<td>Positive</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>3</td>
</tr>
</tbody>
</table>

Of the 78 HIV positive women evaluated, 75 HIV positive women evaluated had negative cervical cancer test as agreed by both VIA and VILI results. In addition, both tests agreed that there were 3 HIV positive women who had positive cervical cancer test results.

**Table 11: Symmetric measures**

<table>
<thead>
<tr>
<th>Measure of Agreement</th>
<th>Value</th>
<th>Asymp. Std. Error</th>
<th>Approx. T</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa</td>
<td>1</td>
<td>0</td>
<td>8.832</td>
<td>0</td>
</tr>
</tbody>
</table>

In the symmetric table, k = 1, p=0.000 (Table 11). The observed level of agreement between the two tests was excellent and therefore the inter-rater reliability was satisfactory.

**DISCUSSION**

Numerous studies have demonstrated that social and demographic characteristics influence the occurrence of cervical cancer among HIV positive women. The relative risk of invasive cancer is increased with increased number of sexual partners, younger age at first sexual intercourse, increasing parity, younger age at first full term pregnancy and increased duration of oral contraceptive use (Berrington, 2007). The study revealed that majority of the HIV positive women (about 49%) were in monogamous marriage and about 24% were single and never married. The rest were either separated or widowed. This contrasted with a study done in Kenyatta National Hospital by ChegeMacharia (Chege, 2013) which showed 60% of women to be in monogamous marriages, 18% were either separated or widowed while 14% were single. This difference could be attributed to the choice of study site that is predominantly urban and is the national referral hospital. This particular study was done in a rural set up while the latter was in the capital city.

About 78% of the respondents had 3 or fewer children while about 22% had 4 or more children. A study done by Bhagwan et al. (Bhagwan, 2007) showed that about 39% of the respondents had 3 or fewer children while about 61% had 4 or more children. Ghazala et al. in a similar study done in Islamabad Pakistan found that 45% of the women had 4 or less children while 55% had 5 or more children (Ghazala, 2013). These studies explain why India and Pakistan are so heavily populated.

The study further revealed that most respondents had less than 2 recent sexual partners which was comparable to a study by Mabeya et al. in which most respondents had less than 2 recent sexual partners (Mabeya, 2012) and Syrjanen et al. in which most respondents had less than 2 recent sexual partners (p=0.001) (Syrjanen, 2005). This study however contrasted with another one done by Were et al. where the majority of respondents actually had more than 2 recent sexual partners (Were, 2010). The reason for this difference could be the different cultural inclinations of the inhabitants of the two areas whereby in the latter polygamy is widely acceptable.
The positivity of Pap smear in this study was 11.5%. This was far below the estimated national positivity of 43% (MOH, 2012). This big difference may have been caused by the failure of the infected women to turn up in large numbers for screening. However the positivity compared favourably with a study done by Rana et al, in which the positivity of Pap smear was found to be 12% (Rana, 2010). A study done in Webuye found a positivity of 22.7% in a similar population (Laktabai, 2009) while a similar study done by Hend S Saleh at the faculty of Medicine of the University of Zagazig, Egypt showed the positivity of Pap smear to be only 4% (Saleh, 2014). This very low positivity in Egypt could be explained by the fact that Egypt is an Islamic country and as such the women are loyal to the Islamic laws that forbid any form of sexual activity before marriage.

There was no association between age in years and the occurrence of abnormal Pap smear results in the study population. Fariba et al also found no association between age and occurrence of abnormal Pap smear in a study of 2 years follow up of referral patients with abnormal Pap smear (Fariba, 2015).

The number of recent sexual partners and Pap smear results were not correlated in the study population. This contradicted Berrington de Gonzales et al study that found that relative risk of invasive cancer was increased with increased number of sexual partners, younger age at first intercourse (Berrington, 2007).

The Government of Kenya recommends use of visual inspection tests as the primary screening tests for cervical cancer while Pap smear may also be used where it is available. The positivity of VIA in this study was 3.8%. This contradicted results of a study done by Laktabai in which the percentage of tests with positive results was 28.2% (Laktabai, 2009). The positivity of VILI in the study was also 3.8%. This also contradicted results of a study done by Sankaranarayanan et al in which the percentage of VILI tests with positive results was 17.8% (Sankaranarayanan, 2003). This apparent low positivity in the visual inspection methods may have been caused by lack of standardized training to Health Care Workers and also due to lack of quality control methods for visual testing.

There were more abnormalities detected on Pap smear than on VIA/VILI (11.5% vs. 3.8%). This contrasted findings by Ghazala et al that show that visual inspection tests have a higher sensitivity than Pap smear and can replace Pap smear as a primary screening tool for universal screening (Ghazala, 2013). In another study by Ghosh et al, 13% of the patients were found to be positive by VIA and 11.71% were positive on VILI. The Pap smear was abnormal in 3.71% (Ghosh, 2012).

This apparent contradiction in the test characteristics of VIA and VILI indicate that they are currently not suitable alternate approaches to cervical cytology in Murang’a District Hospital.

CONCLUSION

There was no agreement between Pap smear and VIA/VILI in detecting suspected cervical abnormalities. Pap smear detected more abnormalities than VIA/VILI and therefore the possibility of HIV positive women visiting reproductive health clinic and leaving without cervical abnormalities being detected could not be ruled out.

REFERENCES


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THE STUDY OF PREGNANT WOMEN BEHAVIOR IN BADUIKANEKES TRIBETO SEARCH THE HEALTH SERVICES IN KANEKES VILLAGE LEUWIDAMAR, LEBAK DISTRICT, BANTEN

Ari Yuniastuti*, WahyuErniaty**

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Abstract: Maternal health is important to note because it concerns the main quality of human resources that is pregnancy time, childbirth and child development. The behavior of pregnant women to choose health care is one of the factors that affect the health of pregnant women. The aim of this study is to find the overview the behavior of pregnant women in BaduiKanekes tribe in search of health services in the sub-district Leuwidamar, Lebak, Banten. The method is using deskriptif-analytic research. The population are all pregnant women with or do not have children <2 years in sub-district Leuwidamar. The Samples are 72 pregnant women. The Samples were taken based on the normal distribution or Gausse Distribution. The criteria of the sample were pregnant women who are willing to follow the research. The experiment was conducted during the month of August 2015 to November 2015. The results showed that the selection of health services has been recognized by pregnant women of BaduiKanekes tribes, thus providing a behavior that is supported by the knowledge and the family. The conclusion of this study is that pregnant women BaduiKanekes tribes prefer to choose medicaster as a place of health services, so it is possible still visit medicaster to get massage.

Keywords: behavior, pregnant women, BaduiKanekes tribe, health care

I. INTRODUCTION

Maternal health is important to note because it concerns for the main quality of human resources that is pregnancy time, childbirth and child development. According to an estimate, around 16 million adolescent women (aged 15–19) give birth every year around the world and most of these births (about 95%) are concentrated in middle and low income countries [1]. Millennium Development Goals (MDGs) included this point into the 5th purpose that is to improve maternal health [2]. Maternal and perinatal health problem is a national problem that needs to be given priority, because childbirth in adolescence is often risky. It is associated with a host of life threatening adverse health outcomes such as high risk of premature delivery, delivery and postnatal complications, unsafe abortions complications, and obstetric fistula etc. [3-8], therefore it is crucial for the quality of human resources as the next generation [9]. Hence, it is not surprising that despite account for only 11% births worldwide, adolescent women carry 23% of overall burden of disease (in terms of disability adjusted life years) due to pregnancy and childbirth among women of all ages [10-11]. Complications of pregnancy and childbirth are also among the leading causes of death among women aged 15–19 year[12].

Pregnancy involves the physically and emotionally changes of maternal and social changes in the family. Generally, pregnancy develop normally and produce healthy babies that are born through the birth canal, but sometimes the condition as not as expected. It difficult to know that a pregnancy would be a problem. Therefore, antenatal care is an important way to monitor and support the health of normal pregnant women and mothers with normal pregnancy detection [13].
Some efforts to improve maternal and infant health and reduce the number of maternal deaths had been done with a variety of family health programs, especially maternal health, which is a national program of the Ministry of Health. The maternal health programs include the service of Antenatal care (ANC), deliveries, postpartum maternal health care, neonatal health care, until care for the baby and the birth planning [14]. Antenatal Care is a program that is planned in the form of observation, education and medical treatment to pregnant women, to obtain a process of pregnancy and childbirth are safe and satisfying [15]. The principle of Antenatal care goal is to provide service or support to improve the health of pregnant women in order to create a family health [16].

The Pregnancy care in initial visits (K1) is the coverage of pregnant women who first received antenatal care by health professionals working in a region at a certain time (Health department, 2009). Repeated pregnancy care visits (K4) is the coverage of pregnant women who have obtained in accordance with standard antenatal care at least four times with the distribution time of 1 time in the first trimester, 1 time in the second trimester, and 2 times in the third trimester, in a region in the period of work certain time [17].

The utilisation of maternal healthcare is a complex phenomenon influenced by several factors. Several studies from developing countries have recognised socioeconomic factors and service delivery environment as important determinants of healthcare utilization. Quality of care, distance to health facility, lack of transport, women’s low social status, age, caste, religion, educational level, economic status of the household, lack of autonomy and decision-making power and cultural norms are some of the factors that have been found to be associated with the utilization maternal care services use in different settings [18-26].

One district that have disparity shows one interesting phenomenon is in District Leuwidamar which is a district that located furthest from the capital of the district if compared to other districts, particularly in the area of Lebak again. The residents in this region generally is Badui Kanekes tribe. The coverage of ANC service especially for K4 only 49.31%, far from the target of 95% with high risk pregnant women at 14.02%, higher than 12.21% in districts. The delivery by health personnel just 42%, from the target of 90%, Visits Neonates (KN3) only 20.16% and Postpartum Visits (KNF3) only 19.61%, the target of 90% [17]. This phenomenon shows that the maternal mortality rate is quite high on Banten regency but at the district level has a different disparity, especially in ritan health center on Leuwidamarsub-district, maternal deaths did not happen.

The overview of the medical care coverage that have inverse proportionally with the facts on the field indicate that non-medical factors influential in improving maternal health. Without prejudice to medical variables when it was realized that of non-medically study is important aspect to explored the comprehensive understanding of social behavior is very necessary so that the health program launched can run effectively and efficiently.

The factors that influence a seeking health behavior can not be separated from the behaviour of person or society itself to search for good quality health services. Such behavior is determined by one of them is the knowledge, attitudes, and beliefs of the individual or the community itself that is referred to as a predisposing factor. Besides, the availability of infrastructure, attitudes and behavior of officers will support and strengthen the formation of such behavior. Based on the problem above, this study aims to describe the behavior of pregnant women in Badui Kanekes in search of health services in the sub-distric Leuwidamar, district Lebak, Banten.

II. METHODS

This study is a descriptive-observational research. The population of research is the entire household that have pregnant women in Sub-district Leuwidamar. The sample of this study was Households that have a pregnant mother of Badui Kanekes tribe. Samples were taken based on the normal distribution or Gaussse Distribution. The number of samples collected were 72 pregnant women. The sample criteria is Pregnant women who are willing to follow the research, Badui Kanekes of 3 generations based on the order of the mother and do not the migration of the study area. The experiment was conducted during the months of August 2015 to
November 2015. The data collection will be stopped if the required data has reached the saturation point (saturation) for qualitative data. Saturated means that the data or information disclosed by the informant is no longer a new thing and tend to repeat information that has been put forward by the previous informant. Primary data obtained from the survey questionnaire and in-depth interviews (in-depth interviews) in pregnant women in the village of Leuwidamar that aimed to examine the behavior of pregnant women in health-seeking actualized by BaduiKanekes. Secondary data were obtained from the relevant agencies that is the district Office and village and also the health centers and health authorities in the research area. The data that collected from the research were processed and analyzed using descriptive-analytic. Descriptive approach using describe phenomena that occur in the field using existing theoretical for solving the problems occurred.

III. RESULTS AND DISSCUSSION

BaduiKanekes pregnant women in an effort to preserve and maintain their health during pregnancy is done in two ways: seeking the health care in the modern health care or health clinics and health workers to either to a midwife or a doctor and also to traditional health care or to the village midwife. The awareness of pregnant women for antenatal check on health workers as many as 31 people, and no antenatal check as many as 41 people (Table 1).

Table 1. The Maternal Behavior in BaduiKanekes checkups to the Health Officer in the District Lebak in 2015

<table>
<thead>
<tr>
<th>Got Pregnancy Examination</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>31</td>
<td>43,1</td>
</tr>
<tr>
<td>No</td>
<td>41</td>
<td>56,9</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100,0</td>
</tr>
</tbody>
</table>

Source: Primary Data 2015

The Pregnant women of BaduiKanekes prever to checkups on midwives as many as 11 people, while on the doctor as many as 4 people and medicaster as many as 16 people (Table 2).

Table 2. Maternal Behavior of Dayak Kenyah to choose Officer Checking Her pregnancy in District tabangKutai regency in 2014

<table>
<thead>
<tr>
<th>The Checking Officer</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwives</td>
<td>11</td>
<td>15,2</td>
</tr>
<tr>
<td>Doctor</td>
<td>4</td>
<td>5,5</td>
</tr>
<tr>
<td>medicaster</td>
<td>16</td>
<td>22,2</td>
</tr>
<tr>
<td>Do not checkups</td>
<td>41</td>
<td>56,9</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100,0</td>
</tr>
</tbody>
</table>

Source: Primary Data 2014

The behavior of pregnant women of BaduiKanekes to choose the health care, village health centers 6 people namely pustu / poskesdes of 3 people, polinides 3 people, society health center 3 people, 2 clinics, hospitals 1 and medicaster 16 people (Table 3).

Table 3. The distribution of Pregnant Woman in BaduiKanekes Tribe Based on the checkups place in District Lebak, Banten regency in 2015

<table>
<thead>
<tr>
<th>Antenatal place</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village Health Centers</td>
<td>6</td>
<td>8,3</td>
</tr>
<tr>
<td>Village polyclinic</td>
<td>3</td>
<td>4,2</td>
</tr>
<tr>
<td>Health Centers</td>
<td>3</td>
<td>4,2</td>
</tr>
<tr>
<td>Clinics</td>
<td>2</td>
<td>2,8</td>
</tr>
</tbody>
</table>
Hospital & 1 & 1.4 \\
Medicaster & 16 & 22.2 \\
Do not Check up & 41 & 56.9 \\
Total & 72 & 100.0 \\

Source: Primary Data 2015

Pregnant women visit of BaduiKanekes tribe that has complete checkups only 1 (one) of every 10 people, while seven (7) out of every 10 pregnant women did not complete checkups (Table 4). Types of ANC services that should be obtained by ANC service standard is at least minimally 7 T or 10 T. The ANC services applied in KutaiKartanegara regency is 10 T, which consists of height measurement, weighing, measuring blood pressure, measurement Upper Arm Circumference (MUAC), fundal height measurements, determine fetal presentation and of fetal heart rate (FHR), screening and immunization status TT vaccine, giving iron tablets (Fe ), laboratory tests (urine check, Hb check), and colloquium case management or counseling [14].

Table 4. Pregnant Woman Behavior of BaduiKanekes tribe Based on Complete Pregnancy Inspection (K4) in District Lebak, Banten regency in 2015

<table>
<thead>
<tr>
<th>Antenatal Check up</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>11</td>
<td>15.3</td>
</tr>
<tr>
<td>K1 dan K2</td>
<td>7</td>
<td>9.7</td>
</tr>
<tr>
<td>K1, K2 dan K3</td>
<td>2</td>
<td>2.8</td>
</tr>
<tr>
<td>K1'</td>
<td>5</td>
<td>6.9</td>
</tr>
<tr>
<td>K1' dan K2'</td>
<td>3</td>
<td>4.2</td>
</tr>
<tr>
<td>K4</td>
<td>3</td>
<td>4.2</td>
</tr>
<tr>
<td>Do not Check up</td>
<td>41</td>
<td>56.9</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary Data 2014

Traditional medical check up to be the choice for pregnant women of BaduiKanekes tribe and family because they feel that antenatal care to the medicaster. It is particularly important to know the health condition of the mother or fetus is in the mother's womb, and also they can get the solution if there are complaints or perceived problems that associated with pregnancy. In fact, they also have an opinion that pregnant woman should check every month. They choose to go to the medicaster because they have felt the benefits based on previous experience or from his family although the antenatal not on time even some of them that check after a complaint that he felt and for fine, they delay the time to check.

Pregnant women on BaduiKanekes tribe, although generally realize that antenatal is important but some are not doing it because some reason like the conditions that do not support like have small children, because they feel ashamed and do not feel the need for feeling fine and no complaints. Here are some the result of the informants interview:

"...Yes, Pregnancy check. Antenatal is later passed one month after menstruation, just doing antenatal. Frequently antenatal after many complaints”. The Benefits of antenatal during pregnancy, the pregnancy can be nice and feeling calm and if not be advised to go at the doctor. Sometimes, we also doing an antenatal in Samarinda beside in the clinic, if fitted milir same family ”. (Su, 33 years old, junior high school, Household, third time pregnant, 2015)
"... Do not antenatal because of shame, still in school and unmarried. but I think that pregnant women is need and importance due to pregnancy check the baby's health and should be done every month ".(Ro, 18 years old, Senior high school, first time pregnant, 2015)

"... I was antenatal to the clinic during pregnancy, up to 5 times to antenatal. It important to check as because it has many benefits, we know the condition of the baby and get vitamins".(Dw, 20 years old, Elementary School, House hold, 2015)

The selection of pregnant women for antenatal check to medicaster or the health centers supported by parents, husband, traditional leaders and even by their own village midwives because they are already aware of the importance and also have felt the benefits. These results are supported by the research results of Agustini et al (2013) which states that there is show a positive relationship between family support with antenatal care coverage [27].

Pregnant women in the BaduiKanekes, Leuwidamar sub-district was pleased with the presence of modern health in their villages, because they feel so difficult when the first time they had to go to the clinic in neighboring districts that must be taken in a long time and furthermore sometime they have to stay just to bring her child immunization.

The Pregnant women on BaduiKanekes tribe still check or "massage" and even born in the same village midwife although already checkups too in the midwife clinic. This is done because they are already accustomed to be massage when they felt unwell, beside that it is also because they feel good and comfortable when sorted when pregnant. But for massage during pregnancy, when the gestational age under 4 (four) months, then the part of the body that should be sorted is another part and don’t at the stomach. Choosing the village midwife to antenatal and give birth because the village midwife is considered to have special abilities, they able to adjust the position of the baby. Some informants interview footage as follows:

"... With Village midwife to be sorted and every month. Do not massage at the stomach, before pregnancy is often massage because it tired as well as after pregnancy. Sort the stomach later after the age of 5 (five) months. For sequential position when it is set, I do not know too mom, how ya example he said as transverse, we set the first, she massage. sometimes they are arranged position while still far away, so that he should not lift have balance position".(Su, 33 years old, junior high, third pregnancy, 2015)

The percentage coverage of ANC services that had been provided to pregnant women has not met the expectations. Some types of services are still very low in the scope furthermore does not reach 50%, including: Giving a counseling to pregnant women only 37.5%, then giving TT vaccine only 34.7% and Hb examination only 22.2%, while the lowest is the urine test that only 4.2%. Several other types of examinations, already more than 50% but has not reached the target of 100% that is body weight examination (84.7%), height measurement (63.9%), measurement of upper arm circumference (70.8%), measurement of blood pressure (79.2%), fundal height measurements (65.3%) and the provision of iron tablets and or multivitamins (68.1%). For the examination of fetal presentation and fetal heart rate, 45.8% had received, 9.7% did not receive 44.4%, while still not yet time for examination by age pregnancy.

CONCLUSION

Traditional medical examination to be the choice for pregnant women of BaduiKanekes and family because they felt that antenatal to the medicaster. The selection of pregnant women for antenatal check to traditional health care supported by parents, husband, traditional tribe figure and even by their own village.

REFERENCES

ID Based Vehicle Parameter Monitoring System In Heterogeneous Mobile Networks

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Abstract- In the future Internet, where the trillion of devices will be connected through expanding mobile network capacity networks (heterogeneous mobile networks) that may vary in both networking and link technologies. Internet of Things (IoT) and Machine to Machine(M2M) communication are expected to be the important model of communications. Either due to mobility or simply switching links, the IoT/M2M devices need to remain connected regardless they change their points of attachment frequently to the network. To meet the needs of devices regarding secured connectivity and seamless mobility in heterogeneous networks, an ID-based communication network architecture is implemented. This ID based communication is mainly used to reduce the transmission delay and provides better connectivity. This paper introduce an design of ID based communication network architecture for monitoring the vehicle parameters in heterogeneous mobile network area without any transmission delay. By using the ID based communication the vehicle parameters are monitored using three different sensors, the measured values are uploaded into the local database and transmission delay is minimized and connectivity is improved.

Keywords: IoT, M2M, ID-based communication, Heterogeneous Networks, Mobility

1.INTRODUCTION

The future wireless mobile communication networks should be able to securely interconnect trillion of devices. The devices connected through heterogeneous networks. The heterogeneous networks will vary in both networking (e.g., IPv4 and IPv6) and wired/wireless access technologies (e.g., cellular, wireless LAN, and low-power, low-range wireless links), and they will frequently change their points of attachment to the networks either because of moving physically (e.g., with humans or vehicles) or simply switching links from one overlapped wireless network to another. Differently from the current Internet hosts, these devices need location-independent, ID based communications over heterogeneous networks. The current Internet offers location-based communication. In that communication scheme the communicating endpoints, are identified by network location-dependent IP addresses. The IP address of a host becomes invalid when the host changes its point of attachment from one location to another, and the communication session that has been using the IP address terminates. Moreover, the Internet principle of end to-end connectivity is not favorable for interworking of heterogeneous network-layer protocols, e.g. IPv4 and IPv6. Therefore, various ID-based communication architectures have been proposed recently for the future networks.

In this paper we describe an ID based vehicle parameter monitoring system for better connectivity and reduce the transmission delay. By using this ID based communications the vehicle parameters are continuously monitored without any delay. The measured parameters are uploaded to the local database continuously. The vehicle parameters (temperature, coolant level, brake failure status) are measured by using the sensors. To indicate that the vehicle is in normal or extreme condition threshold values are fixed. For the normal condition the value is equal to the threshold level. For the extreme condition the values are below or above the threshold. The measured values are stored in the local database. The transmission delay minimization is implemented by using NS2 simulator.

2.BLOCK DIAGRAM
The block diagram for the vehicle parameter monitoring is shown in the Figure 1.1. The system consists of three different sensors to detect the temperature, level and brake failure indication. The temperature sensor and the level sensor output is connected to the Analog to Digital converter. The output of these sensors will produce the analog signals. To convert the analog signal into digital signal the output is given to ADC. Then the ADC output is connected to the Raspberry pi module. The output of brake failure indication is directly connected to the Raspberry pi module. Then Raspberry pi module outputs are connected to the RS232 which consist MAX232 ic. Then the values are display to the PC by using RS232 to comport converter. The vehicle parameters conditions are displayed in the PC.

3. HARDWARE DESCRIPTION

The Raspberry pi 2 microcontroller is used since this is compact in size and the power consumption is too low. Broadcomchip BCM2836 SoC is placed in it and it has a memory of 1GB RAM with 900MHz frequency. Raspberry Pi 2 board is selected because it is fast when compared to the earlier versions. Many sensors or peripherals can be interfaced with it at the same time and can work very fast as the quad core processor is used here. This processor allows us to interface many modules at a time. It has 40 GPIO pins and 4 USB ports also which allows us to connect our Wi-Fi module etc. The temperature sensor used here is Thermistor 743. As it is an analog sensor so it is connected to ADC to convert to digital signal and the ADC output is interface with the raspberry pi board. It is used to sense the ambient temperature of the coolant of the vehicle. This sensor is connected with the GPIO pins. The working of the sensor is based on the temperature. The temperature value varied means the resistance varies.

Level sensor is used in order to sense the water level in vehicle. Float is the one type of transducer which is used to measure the water level in the tank. The float changes the resistance value depending on the water level. Float changed means the resistance value also varied. If resistance value increased means output also increased. The resistance value and output is a directly proportional one.

In communications, RS-232 is a standard for serial binary data interconnection between two terminals (DTE and DCE). It is commonly used in computer serial ports for data transmission. In this circuit the MAX 232 IC used. It used as logic level converter. The MAX232 is a dual driver/receiver. It includes a capacitive voltage generator. This is used to supply EIA 232 voltage levels from a single 5v supply. Each receiver and driver converts supply voltages from EIA-232 to 5v TTL/CMOS levels and TLL/CMOS input levels into EIA-232 levels respectively.

The MCP3208 12-bit Analog-to-Digital Converter (ADC) is a high performance and low power consumption, making it ideal for embedded control applications. The MCP3208 features a successive approximation register (SAR) architecture and an industry-standard SPI serial interface, allowing 12-bit ADC capability to be added to any PICmicrocontroller. The MCP3208 features 100kpbs, 8 channels as input, low power consumption, and is available in 16-pin PDIP and SOIC packages. Microchip Technology Inc. MCP3208 device is a successive approximation 12-bit Analog-to-Digital (A/D) Converter with on-board sample and hold circuitry. The MCP3208 is programmable one and to provide four pseudo-differential input pairs or eight single-ended inputs.

4. SOFTWARE DESCRIPTION

The raspbianos is used in the raspberry pi controller. It is a free operating system that is based on Debian which is particularly optimized for the Raspberry Pi controller. It comes with over 35,000 packages and pre-compiled software bundled in a simple format for easy installation in the Raspberry Pi.

The coding for all the sensors are done using the python coding. Python is preferred since it is a simple and a minimalistic language. It is also a free and a open source software. This can be used in many platforms such as Linux, VxWorks, PocketPC etc. Also, it supports procedure-oriented programming as well as OOPS. The web browser is created by using HTML.

NS-2 stands for Network Simulator version 2. It is a discrete event simulator for networking research. It provide substantial support to simulate bunch of protocols like Transmission Control Protocols (TCP), User Defined protocol (UDP), File Transfer Protocol (FTP), Hyper Text Transfer Protocol (HTTP) and DSR. It will simulate wired and wireless network. It is primarily Unix-based. NS2 uses TCL as its scripting language. Network Simulator 2 (NS2) is a program designed to enable the simulation of networking scenarios without hardwares. It can be used to test many aspects of a networking environment including the development of new protocols. The program itself is notoriously difficult to install and runs on either windows or Linux.
5. PROPOSED WORK

The main idea of the proposed method is to design an ID based vehicle parameter monitoring system implemented by using the Raspberry Pi board. The Raspberry Pi module has the ability to build enough powerful mobile sensor devices that can easily include various types of sensors and also can run code for monitoring and mobility functions. It requires a significant amount of power (5V, 700-1000mA), running on a battery for a long time (i.e., more than a day) is possible. The three sensors called temperature, level, and brake failure status are fixed in the vehicle to monitor the parameters and the values are collected from the raspberry pi module to PC and it will be uploaded to the database. The thermistor which is used to measure the temperature and it will produce the analog output. The output is given to the ADC to convert it into a digital value and then connected to the raspberry module. To measure the level the probe is used. Whenever the probe changes its resistance value also changes. The output is given to the inverting amplifier and again passed to the gain amplifier. The analog output converted into digital then connected to the Raspberry pi. Brake failure status is monitored by using the NOT gate IC. And the output is given to Raspberry pi. From the module the outputs are connected to the RS232 which consists of MAX232 can transmit data to the PC.

6. ALGORITHM FOR PARAMETER MONITORING

Step 1: Give power supply to the raspberry pi kit board.
Step 2: Open VB.NET software in the PC
Step 3: Open file and select open in that open website.
Step 4: Copy the location from that open website link and click open.
Step 5: Then click debug and select start debugging. The new website is opened.
Step 6: If the temperature and level values are equal mean it display as normal otherwise it display as sensor is in below level.

7. EXPERIMENTAL RESULTS

The remote monitoring and control of devices is possible by using this ID based communication in heterogeneous networks. This ID based vehicle parameter monitoring system consists of sensors. By sending the monitoring parameters range, the user can get information about the vehicle's current status such as if it is in normal or extreme condition.

The following are the experimental results. Figure 1.2 shows the screenshot of the created web browser and vehicle parameter monitoring system. The sensors are interfaced with raspberry pi with ADC the values are displayed to PC using RS32 to serial port converter.

A. PARAMETER MONITORING RESULTS

During Normal condition, the temperature and the level sensor values are equal to the threshold values and the brake failure status is normal. The normal condition is as shown in the Figure 1.3.

During extreme condition, the temperature and the level sensor values are not equal to the threshold values and the brake failure status is failure. The value is below or above the threshold value. The different extreme condition is as shown in the Figure 1.4 and Figure 1.5.

B. DELAY MINIMIZATION RESULTS

The normal location based system consists delay because of changing position of the hostname from one point to another. When moving one point to another it will take sometime to capture the next host name. The below result shows that the location based communication consists of two different points to cover the different regions. From the two different road side units the information will be transmitted to the base station.

The location based communication consists of delay. This delay is minimized by using ID based communication. In this a single ID is used to cover the entire region instead of using the two different units. Vehicle parameter conditions are transmitted to this single ID and it will be transmitted to the base station. So the delay will be minimized by using this scheme. The figure 1.7 shows that it consists a single ID and base station.
8. CONCLUSION AND FUTURE WORK

Thus the ID based vehicle parameter monitoring system monitors the extreme temperatures, coolant level and brake failure status by using the sensors. The measured values are read from ADC then stored in the raspberry pi. The measured values are uploaded to the database by using the VB.NET. The transmission delay time is minimized by using the NS2 simulator. As ID based vehicle parameter monitoring system monitor the three parameters such as temperature, coolant level and brake failure status and values updated to the database and the delay is minimized. In future, this project is extended to tracking moving objects such as animals and humans without any disconnection and also in remote health care application.

9. REFERENCES


11. LIST OF FIGURES:
Fig 1.1 Block diagram

Fig 1.2 Vehicle Parameter Monitoring System

Figure 1.3 Normal Condition
Figure 1.4 Different Extreme condition 1

Figure 1.5 Different Extreme condition 2

Figure 1.6 Locator based communication result

Figure 1.7 ID Based Communication Result
Bibliometric Study of Journal of Marketing Research, 2008-2016

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Carmelite Provincial House, Ernakulam

I. INTRODUCTION

The journals which communicate primary information about research and development have an important role in bringing relevant information about particular subjects. Information explosion in various subject field also affect the number of journals. The increase in number of journals makes confusion among librarians to subscribe journals. Due to the financial problem it is not worthy to subscribe all journals. Bibliometric studies are very helpful for librarians in framing better collection development policies and information services.

Bibliometric studies have been conducted on journals are based principally on various elements such as author, title, subject, citations and so forth. This type of analysis provides useful indicators of trends, scientific productivity, emphasis of research in various fields, and researcher preferences for publication. This study provides some bibliometric analysis related to Journal of Marketing Research which is a prominent journal published by AMA in the field of marketing research.

II. OBJECTIVES

- To examine the number of contributions and the pattern of growth of article published in JMR during 2008-2016.
- To find year wise distribution of authors
- To find the year wise distribution and range of citations
- Sources of references; and
- Country-wise collaborative research productivity

III. REVIEW OF LITERATURE

Rao, Nageswara K. et al. studied Journal of Propulsion and Power which is a bi-monthly peer reviewed journal published by American Institute of Aeronautics and Astronautics (AIAA). This bibliometric analysis is based on 4047 articles published from 1985 to 2013. The study is aimed to assess the growth pattern of research output, authorship pattern, institutional productivity, and geographical distribution of output. The highest number (194) articles were published in year 1992 and lowest (81) in 1987. Out of total articles, 1330 were produced by two authors and 1098 by three authors. It is found that 1205 different institutions were involved in publication of articles. ‘Purdue University’ contributed highest number of 163 articles. From top 27 ranked list of authors who have contributed alone or co-authored along with other authors, it is found that Fleeter, S. from Purdue University, USA has authored and co-authored highest number of 54 articles.

Garg, K.C., and A.K. Anjana analyzed 605 papers published in the Journal of Intellectual Property Rights during 1996-2012, which indicates that the inflow of papers has increased during the period of study. The increasing in flow of articles show the popularity of journal among the scientific community as well as policy makers. The study shows that number of references per paper is increasing and the average reference per paper is 23. The proportion of single authored papers is decreasing, while the share of multi-authored papers is on the rise. About one-fourth of the papers published in the journal are from abroad and the rest from India. Among foreign countries US is the largest contributor. Among the performing sectors, academic institutions are the largest contributors to the journal followed by research institutions. As an agency, CSIR has contributed the highest number of papers and several of the prolific institutions and authors are also from CSIR.

Pandita, Ramesh conducted a study to assess the amount of research published in only LIS journal from Jammu & Kashmir, enjoying fair amount of readership at global level and to see how far the journal is being preferred by local, national and international LIS professionals to publish their research results. Present study examines article distribution pattern of the journal, authorship pattern, geographical distribution of authors and citation analysis.. India emerges the largest contributor with maximum of 63 articles, majority of them i.e. 35 articles contributed from state of Jammu & Kashmir. Maximum no. of 41 articles contributed are single authored. Further, a total of 1403 references have been cited with an average of 14.76 references/article. Bibliometric studies are important for that fact that these act as SWOT (Strength, Weakness, Opportunities and Threats) tool to analyze and evaluate the amount of research activities being undertaken by professionals of a particular science..

Thavamani, Kotti analyzed the various bibliometric components of the articles published in the Malaysian Journal of Library and Information Science from 1996 to 2012. Various quality aspects of the 279 articles published in the period were studied. The study demonstrates and elaborates on the various aspects of the journal, such as its distribution of article by year, authorship patterns, distribution of contributions by institution, subject distributions, citation patterns, length of article, and geographical distributions of authors. Analysis of data reveals that more number of research articles are published from Malaysia followed by India.. Citation analysis of 6779 citations includes finding out average number of citations per contribution. The average degree of author collaboration has been arrived at 0.645 during the study period.
IV. ANALYSIS AND FINDINGS

A. YEAR WISE DISTRIBUTION OF ARTICLES PER ISSUE

Table 1 represents year-wise distribution of articles and average number of articles per issue published in the Journal of Marketing Research during the period given below:

Table 1: Year Wise Distribution of Articles Per Issue

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of articles</th>
<th>Issues</th>
<th>Percentage</th>
<th>Average no</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2008</td>
<td>56</td>
<td>6</td>
<td>9.08%</td>
</tr>
<tr>
<td>2</td>
<td>2009</td>
<td>65</td>
<td>6</td>
<td>10.53%</td>
</tr>
<tr>
<td>3</td>
<td>2010</td>
<td>92</td>
<td>6</td>
<td>14.91%</td>
</tr>
<tr>
<td>4</td>
<td>2011</td>
<td>91</td>
<td>7</td>
<td>14.75%</td>
</tr>
<tr>
<td>5</td>
<td>2012</td>
<td>72</td>
<td>6</td>
<td>11.67%</td>
</tr>
<tr>
<td>6</td>
<td>2013</td>
<td>51</td>
<td>6</td>
<td>8.27%</td>
</tr>
<tr>
<td>7</td>
<td>2014</td>
<td>66</td>
<td>6</td>
<td>10.70%</td>
</tr>
<tr>
<td>8</td>
<td>2015</td>
<td>58</td>
<td>6</td>
<td>9.40%</td>
</tr>
<tr>
<td>9</td>
<td>2016</td>
<td>66</td>
<td>6</td>
<td>10.70%</td>
</tr>
<tr>
<td>Total</td>
<td>617</td>
<td>55</td>
<td></td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Out of 617 articles, the highest numbers of articles were published in the year 2010 contributing 92 (14.91%) and the lowest numbers of articles were published in 2013, contributing 51 (8.27%) to the total number of articles. From the figure we can understand that growth rate of the journal is in a zig-zag manner. There is no steady growth and decline. It can be seen that a steady growth from 2008 to 2010 and from 2011 to 2013 there is a little decrease then slight increase again decrease and last in 2016 there is small increase.

Figure 1: Line chart shows yearwise distribution of article during the period 2008-2016

B. YEAR WISE DISTRIBUTION OF NUMBER OF AUTHORS

Table 2 traces year wise distribution of number of authors during the period 2008-2016.
Table 2: Year wise Distribution of number of Authors

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Number of Authors</th>
<th>Number of Articles</th>
<th>Percentage of Authors</th>
<th>Average No. of Authors/Article</th>
<th>Average No. of Articles/Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>149</td>
<td>56</td>
<td>8.96%</td>
<td>2.66</td>
<td>0.38</td>
</tr>
<tr>
<td>2009</td>
<td>185</td>
<td>65</td>
<td>11.12%</td>
<td>2.85</td>
<td>0.35</td>
</tr>
<tr>
<td>2010</td>
<td>250</td>
<td>92</td>
<td>15.03%</td>
<td>2.72</td>
<td>0.37</td>
</tr>
<tr>
<td>2011</td>
<td>247</td>
<td>91</td>
<td>14.85%</td>
<td>2.71</td>
<td>0.37</td>
</tr>
<tr>
<td>2012</td>
<td>200</td>
<td>72</td>
<td>12.03%</td>
<td>2.78</td>
<td>0.36</td>
</tr>
<tr>
<td>2013</td>
<td>136</td>
<td>51</td>
<td>8.18%</td>
<td>2.67</td>
<td>0.38</td>
</tr>
<tr>
<td>2014</td>
<td>139</td>
<td>66</td>
<td>8.36%</td>
<td>2.11</td>
<td>0.47</td>
</tr>
<tr>
<td>2015</td>
<td>172</td>
<td>58</td>
<td>10.34%</td>
<td>2.97</td>
<td>0.34</td>
</tr>
<tr>
<td>2016</td>
<td>185</td>
<td>66</td>
<td>11.12%</td>
<td>2.80</td>
<td>0.36</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1663</strong></td>
<td><strong>617</strong></td>
<td><strong>100.00%</strong></td>
<td><strong>2.70</strong></td>
<td><strong>0.37</strong></td>
</tr>
</tbody>
</table>

It is observed that while ignores repetition of authorship, 1663 authors have contributed 617 articles with an average of 0.37 articles per author. The average authorship per article was 2.70. The average number of author per article was very less (2.11) and the average number of article was very high (0.47) in the year 2014.

Figure 2: Line chart shows year wise distribution of authors during the period 2008-2016

C. **Year wise Distribution of Citations**

Table 3 shows year wise distribution of citation of Journal of Marketing Research during the period 2002-2016.

Table 3: Year Wise Distribution of Citation

<table>
<thead>
<tr>
<th>Year</th>
<th>No.of articles</th>
<th>No.of citations</th>
<th>percentage</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>56</td>
<td>2714</td>
<td>9.68%</td>
<td>48.46</td>
</tr>
<tr>
<td>2009</td>
<td>65</td>
<td>2802</td>
<td>7.29%</td>
<td>43.11</td>
</tr>
<tr>
<td>2010</td>
<td>92</td>
<td>3979</td>
<td>10.36%</td>
<td>43.25</td>
</tr>
<tr>
<td>2011</td>
<td>91</td>
<td>3788</td>
<td>9.86%</td>
<td>41.63</td>
</tr>
<tr>
<td>2012</td>
<td>72</td>
<td>3214</td>
<td>8.37%</td>
<td>44.64</td>
</tr>
<tr>
<td>2013</td>
<td>51</td>
<td>2796</td>
<td>7.28%</td>
<td>54.82</td>
</tr>
</tbody>
</table>
The listing of references in publications is a convention among scientists for giving credit or recognition to the value of previous work. The total number of citations used in 617 articles is 28047. The highest number of citations, 3979, was used in the year 2010 (10.36%), followed by 3788 (9.86%) in the year 2011, 3214 (8.37%) in the year 2012, 3045 (7.93%) in the year 2016, 2889 (7.52%) in the year 2015, and so on. From the table and chart, it is clear that the citation rate is very high in the year 2013 on which the average number of citations per article is 54.82. The citation rate is very low in the year 2005 on which the average number of citations used per article is 27.31. On an average, JMR authors have cited over 45.46 references per article. Hence, it is inferred that JMR authors have conducted their research with ample evidences from earlier studies.

<table>
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D. Year wise Distribution sources of Citations

Table 4 lists the sources of citations used in the journal during the years from 2002 to 2013.

### Table 4: Sources of References

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</table>

Table 4 shows majority of the authors preferred to use Journal articles as the source of reference or citation, which accounts for 22667 (80.82%) out of the total 28047 citations. The second highest used source is Books with 3049 (10.87%) citations. It is followed by Websites with 1227 (4.37%) and Working papers 907 (3.23%) are cited. Other sources like Seminars/ Conference proceedings 101 (0.36%) and Theses and dissertations 96 (0.34%) are also used for citation in a very limited number.
C. COUNTRY-WISE DISTRIBUTION OF AUTHORS

Table 5 shows that country wise distribution of articles of journal during 2008-2016.

Table 5: Country wise distribution of authors

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</table>
Table 5 shows that most of the authors are from USA which is the origin country of the journal JMR. The second place goes to China and 3rd place goes to Netherland for producing article. Institution wise collaboration and country wise collaboration are taken by authors to produce article. But 60.49% authors write article collaborates with others who belong to the institution in same country. Collaboration with other country is 39.51%
its readers, peers and academic community at length consequently taking its reputation to a lofty height!

REFERENCES


AUTHORS

First Author – Jincy Joseph, MSc, MLISc., Carmelite Provincial house, Ernakulam,Kerala,India, jincycmc@gmail.com
Root and shoot growth of semi-hard wood cuttings of Mulberry (*Morus indica L.*) influenced by water imbibitions using wet cloth wrapping technique


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Abstract: An experiment was conducted at Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA&RI), Karaikal, Union Territory of Puducherry, India; to investigate shoot and root growth of semi-hard wood cuttings in Mulberry (*Morus indica L.*) varieties ‘Victory 1’ and ‘S₃₆’, influenced by water imbibitions using “wet cloth wrapping technique”. Semi-hard wood cuttings were subjected to different days of water treatments using wet cloth wrapping method. The experiment was laid out and data’s were analyzed using single factor ANOVA. The cuttings were subjected with different days of water treatments, which are then planted in the rooting media and kept under shade net condition. For preparing rooting media, soil, sand and farm yard manure (FYM) in ratio of 1:1:1 by v/v were mixed thoroughly, cleaned for stones and grasses, then the mixture was filled in polythene bags. Parameters namely number of sprouts, sprout length, number of leaves per sprouts, root length and number of roots per cuttings were taken at 60th day. The cuttings subjected with 20 days of water treatments of the variety ‘Victory 1’ performed best with regards to root length and number of roots per cutting. It was also observed that cuttings subjected with 25 days of water treatment have performed best over other treatments with regards to number of leaves per cuttings and number of sprouts per cuttings of the varieties ‘Victory 1’ and ‘S₃₆’.

Key words: Mulberry, cuttings, water imbibitions, root length, number of roots, sprout length, transplanting, nursery.

Introduction:

Mulberry (*Morus sp.*) is known to be originated from China, India, Turkey, Russia and Middle Eastern countries (Islam et al., 2003). Mulberry has been cultivated over thousands of year and has been adapted to a wide area of tropical, subtropical and temperate zones of Asia, Europe, North and South America and Africa (Ozgen et al., 2009). The world’s most common mulberry application is the use of its leaves in the domestication of silkworm, and the most important countries in this respect are China and India. On the other hand, Central Asia and the Middle East consume mulberry fruit (Sanchez, 2000). The main species are *Morus nigra, Morus alba, Morus rubra, Morus australis, Morus latifolia* and *Morus multicaulis* (Yasin et al. 2003).
Mulberry has been cultivated throughout the year in the southern parts of India namely Karnataka, Andhara Pradesh, Tamil Nadu and Telangana, for Sericulture.

In India, mulberry semihard wood cuttings are used as propagating material which are either directly planted in the mainfield or can be nursery raised and then transplanted after 90 days. Direct planting of mulberry cuttings in main field leads to poor establishment rate and hence they are raised under nursery condition and then transplanted after 90 to 120 days. However, even under nursery raised condition, percentage of success depends on season at which they are grown. The success rate of sprouted and rooted saplings under nursery rose condition will be best, when they are raised during monsoon seasons (South west and North east monsoons of India). The cuttings planted in August, performed the best in all aspects namely number of sprouted cutting, average number of sprouts, length of longest sprout, diameter of thickest sprout, number of leaves on new shoots, shoot percentage, fresh and dry weight of shoot, root percentage, number of primary root, secondary root, length of longest root, fresh and dry weight of roots (Singh, et al., 2015). Water imbibitions of mulberry cuttings induces early sprouts and root growth; and for this reason cuttings which are grown during rainy season performed better success rate. Hence, an attempt has been made to induce the early sprouts and root growth of mulberry cuttings influenced by water imbibitions subjected with ‘wet cloth wrapping technique’. Early shoot and root growth of cuttings may be hardened and can be transplanted at the earliest. Pre-ponement of transplanting schedule of mulberry rooted and sprouted saplings at 60th day instead of recommended 90th day using ‘Wet cloth wrapping technique’ would benefit sericulture farmers. In this regard, a research has been carried out on the effects of water imbibitions on mulberry semi-hardwood cuttings on shoot and root growth, influenced by wet cloth wrapping technique, at PAJANCOA & RI, Karaikal, U. T. of Puducherry, India.

Materials and Methods:

Selection of planting materials:

Semi-hardwood cuttings were selected from a well established garden of 8 - 12 months old. Full grown thick main stem (pencil thickness size) free from pest and disease damages having a diameter of 10-12 mm was chosen for preparation of cuttings. The cutting with length of 15-20 cm with 3-4 active buds were selected for the experiment and a slant cut was made with
an angle of 45° at the bottom end. Care was taken to make a sharp cut at both the ends of cuttings without splitting the bark using a ‘Secature’. The experiment was conducted in two ruling varieties namely Victory 1 (High yielding type) and S₃₆ (Succulent leaves for Chawki rearing). The variety ‘Victory 1’ is a hybrid obtained from S₃₀ and Ber C776; while the variety S₃₆ was developed through EMS treatment of Berhampore local. The varieties S₃₆ and Victory 1 were developed at CSTRI, Mysore, India and were recommended to sericulture farmers in the year 1984 and 1996 respectively.

**Rooting media:**

For preparing rooting media, soil, sand and farm yard manure (FYM) in ratio of 1:1:1 by v/v were mixed thoroughly, cleaned for stones and grasses, then the mixture was filled in polythene bags (Plate 2).

**Wet cloth wrapping technique:**

The experiment was performed with five sets of cloth wrapped cuttings; each consisting of ten numbers and was treated with different days of water treatment namely 5, 10, 15, 20 and 25 days respectively of the variety ‘Victory 1’ and ‘S₃₆’. The wrapped cuttings were kept in an enamel tray with thin film of water and were sprinkled over with water during morning and evening hours. The wrapped cuttings in the enamel tray were kept under room temperature (25 ± 2° C) during the entire treatment period. Exactly on 6th, 11st, 16th, 21st and 26th day, corresponding with 5, 10, 15, 20 and 25 days of water treatments, the cuttings were planted on rooting media at a depth of 5cm to 7 cm. The planted cuttings in the polythene bags were maintained under shade net condition for 60 days (including the water treated conditions), with watering once in seven days.

**Nursery Grown Cuttings:**

A Nursery bed was prepared under non-shady conditions using loamy soil with a size of 3 x 1.7 meters and was irrigated once in a week. Exactly 20 cuttings each from the variety Victory 1 and S₃₆ were selected and a total of 40 cuttings were planted in the raised bed. Upon attaining 60 days of nursery raised conditions (DNRC), 10 cuttings each from the variety Victory 1 and S₃₆ were taken for observation of shoot and root growth. Again on 90 DNRC, another 10
cuttings each from the variety Victory 1 and S_{36} were taken for observation of shoot and root parameters (Plate 2).

**Root and shoot parameters:**

Parameters like average number of sprout, average shoot length, average number of leaves, average number of roots, and average length of roots per cuttings were taken for analysis purpose.

**Statistical analysis:**

The shooting and rooting performance of various treatments were analyzed using Analysis of variance (ANOVA) on SPSS statistical software.

**Results and discussion:**

**Effects of water imbibitions on rooting performance of mulberry cuttings:**

In case of rooting performance of variety Victory 1, significantly maximum number of roots per cuttings was found under the treatments 60 DNRC (14.3), 90 DNRC (17.4) and 20 days (11.4). The results indicated, cuttings subjected with 20 days of water treatments influenced by wet cloth wrapping technique had performed best over others. Kalyoncu et al., 2009, reported highest rooting percentage was recorded in softwood top cuttings of mulberry (*Morus alba* L.), which were planted in pumice medium under misting system under greenhouse condition for 48 days. Heavy flushing was also observed during rainy periods, a time of intensive vegetative growth, which may tend to increase rooting percentage (Singh et al., 2015). They also reported that, poor rooting in the cuttings which were planted during cooler time of the season might be due to the fact that these cuttings might have been carrying higher inhibitor to promote ratio or it might be due to higher nitrogen to carbohydrate ratio. It was also observed that the least number of roots per cuttings was observed in the treatment 5 days (1.8), while the treatments 10 days (4.4), 15 days (3.3) and 25 days (7.4) were performed in a similar trend (Table. 2; Plate 1).

Regarding the variety S_{36}, number of roots per cuttings was found significantly superior in the control treatments 90 DNRC (17.4) and 60 DNRC (14.3). However, the cuttings subjected with 25 days of water treatments (9.2) were on par with the treatment 60 DNRC. The cuttings subjected with 5 days (4.9), 10 days (4.0), 15 days (3.8) and 20 days (5.1) of water treatments shows similar trends of root growth (Table. 2). The results clearly indicated, water imbibitions
on the variety S₃₆ did not have major effects on the number of roots per cuttings. According to Singh et al. (1961) hardwood cuttings produced a higher rooting percentage with vigorous root system than semi-hardwood cuttings. Poor performance of roots per cuttings of the variety S₃₆ might be due to inheritance.

In case of average root length per cuttings of the variety Victory 1, significantly treatments namely 60 DNRC (5.85) and 90 DNRC (7.78) performed best over others. However, cuttings subjected with 20 days (5.43) and 25 days (4.08) of water treatments; and 60 DNRC (5.85), were on par with each other. This has indicated, cuttings subjected with 20 days and 25 days of water treatments were superior over other water treated cuttings. Whereas, cuttings subjected with 5 days (0.57), 10 days (2.37), 15 days (1.14) of water treatments had not performed well with regard to average root length (Table 2). Harrison-Murraya (1991) observed that the seasonal timing, or the period of the year in which cuttings are taken, can play an important role in rooting. Blazich (1987) reported that time of year when cuttings are taken is an important factor influencing rooting of woody plants from stem cuttings. Prolings and Therios (1976) showed that creating humid atmosphere by means of artificial mist around the planted cuttings either in concealed pot culture house or in open conditions has proved to enhance the process of rooting.

With regards to variety S₃₆, significantly maximum root length was recorded under the control treatment 90 DNRC (6.86) over the others. The results also recorded, cuttings subjected with 5 days (2.2), 10 days (2.96), 15 days (2.86), 20 days (2.82) and 25 days (3.35) of water treatments; and 60 DNRC (4.24) had performed similar trends, indicating water imbibitions on mulberry cuttings did not have any effects on root length with respect to the variety S₃₆ (Table 2). According to Singh et al, (1961) hardwood cuttings produced a higher rooting percentage than semi-hardwood cuttings. They also noted that the best time for taking cutting in Phalsa was July-August than in September.

**Effects of water imbibitions on shooting performance of mulberry cuttings:**

In case of shooting performance of varieties Victory 1 and S₃₆, number of sprouts per cuttings which are subjected with different days of water treatments namely 5 days (1.2 and 1.1), 10 days (1.4 and 1.1), 15 days (1.2 and 1.0), 20 days (1.6 and 0.8), 25 days (1.8 and 1.0), 60 DNRC (1.0 and 1.0) and 90 DNRC (1.5 and 1.4) seems to be non-significant at 0.05%. The
results indicated, irrespective of different days water treatments, the number of sprouts per cuttings seem to be in a similar trend between treatments in both the varieties Victory 1 and S₃₆ (Table.1). The results have clearly indicated, there was an early growth with respect to number of sprouts per cuttings which are subjected with water imbibition influenced by wet cloth wrapping technique. Hence, water imbibitions of cuttings have physiologically activated the dormant buds earlier, than recommended nursery raised cuttings (60 and 90 DNRC). Similar findings were reported by Singh et al., 2015, who reported that mulberry (Morus alba. L) hard wood cuttings grown under mist chamber condition during the month of mid July performed maximum average sprouted cuttings (4.11). In propagating deciduous species, hardwood and semi-hardwood cuttings can be taken during the dormant season when buds are not active and before buds start to force out in the rainy season (Singh et al, 2015). Evans (1992) contended that probably the best time to take cuttings from the field is at the beginning of the rainy season.

With regards to average shoot length per cuttings, significantly the maximum number of shoot length was recorded under 60 DNRC (23.95; 21.94) and 90 DNRC (24.88; 22.93) of the variety Victory 1 and S₃₆. The shoot length of cuttings was 4.12 and 7.87; 13.79 and 10.13; 10.85 and 9.06; 9.08 and 8.65; 13.82 and 10.95 under 5, 10, 15, 20 and 25 days of water treatments of the variety Victory 1 and S₃₆, respectively. The shoot length of cuttings was almost in a similar trend under 5, 10, 15, 20 and 25 days of water treatments influenced by wet cloth wrapping technique. However, minimum number of shoot length (4.12) was observed under 5 days of water treatments in the variety Victory 1 (Table.1; Plate 1). The results indicated, the water imbibitions of semi-hard wood cuttings did not have an impact on the shoot length. However, the nursery rose cuttings have performed best with respect to the shoot length. This may be due to the geotropism effects, as the nursery rose cuttings were kept at a slant position during the entire nursery period. However, the cuttings which were subjected with different days of water treatments were kept in a horizontal position (Plate 1). This may be the reason for poor shooting performance of cuttings which were subjected with water imbibitions.

The average number of leaves per cuttings of the variety Victory 1 under different water treatments are 2.58 (5 days), 4.3 (10 days), 3.28 (15 days), 2.82 (20 days), 4.23 (25 days), 5.00 (60 DNRC) and 5.00 (90 DNRC), which were not significant at 0.05% (Table. 1; Plate 1). The result clearly indicated, wet cloth wrapping of cuttings have significant role in inducement of early growth with respect to number of leaves per cuttings. Singh et al, 2015 reported, favorable
climatic conditions play an important role to increase the number of leaves. The appropriate planting time, application of IBA as well as genetic makeup of genotype use might have played some role in augmenting the number of leaves per cuttings (Singh and Singh, 2002)

In case of average number of leaves per cutting of the variety $S_{36}$, significantly maximum number of leaves per cutting was recorded under 60 DNRC (4.6), 90 DNRC (5.0), 25 days (4.12) and 10 days (3.75). The results furnished the cuttings which were subjected with water treatments for 25 days performed best over others. The results also indicated, least number of leaves per cutting was observed under the treatment 20 days, whereas number of leaves per cuttings under the treatments 5 days and 15 days were on par with each other (Table.1; Plate 1). Hence, similar trends were followed as like that of the variety Victory 1 with regards to number of leaves per cuttings. Singh et al, 2015, reported shooting efficiency would be better when it is done in control conditions such as mist chamber.

**Conclusion:**

The conclusion drawn from the present study are discussed below,

- The results indicated that the wet cloth wrapping technique had made major impact on the rooting and shooting performance of cuttings.
- Mulberry cuttings grown during rainy season alone have a better success rate. But using ‘wet cloth wrapping technique’ mulberry growers can have higher success rate even during non-rainy season.
- Water imbibitions of semi-hardwood cuttings using wet cloth wrapping technique have made an early induction of shoot and root growth over the conventional nursery raised rooted saplings, by breaking the dormancy of vegetative buds at the earliest.
- The cuttings subjected with 20 and 25 days of water treatments of the variety ‘Victory 1’ performed best with regards to root length and number of roots per cutting.
- Regarding the variety $S_{36}$, cuttings subjected with different days of water treatments influenced by wet cloth water treatments did not have a major impact on root length, number of roots and shoot length per cuttings.
- The cuttings subjected with different days of water treatments of the variety ‘Victory 1’ and $S_{36}$ performed best with regards to number of sprouts and leaves per cuttings.
- ‘Wet cloth wrapping technique’ may be practiced in planting material which are of horticultural importance for better success rate, propagated through hardwood, softwood and semi-hardwood cuttings.
Acknowledgement:

I am indebted to thank Dr. Kumar. K, Prof. and Head, Dept. of Agrl. Entomology, PAJANCOA & RI, Karaikal, India, for his meticulous support during the experimental period. I am also thankful to Mr. Ayoob. K. C, Assistant Professor (Statistics) for helping in statistical analysis of data. I extend my thankfulness to Dr. Kandibane. M, Assistant Professor (Entomology) and Dr. Marichamy. M.S, Assistant Professor (Horticulture), for their guidance in proper conduct of the experiment.

Reference:


**Table 1.** Effects of water imbibitions influenced by wet cloth wrapping technique on the shooting performance of mulberry (*Morus indica* L) varieties ‘Victory 1’ and ‘S36’

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<th>Average Shoot length per cuttings (in Cm)</th>
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<td>5 days</td>
<td>1.2NS</td>
<td>4.12&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>7.87&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.1NS</td>
<td>13.79&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.13&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>2.</td>
<td>10 days</td>
<td>1.4NS</td>
<td>10.85&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>9.06&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>3.</td>
<td>15 days</td>
<td>1.2NS</td>
<td>9.08&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>8.65&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>4.</td>
<td>20 days</td>
<td>1.6NS</td>
<td>13.82&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.95&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>5.</td>
<td>25 days</td>
<td>1.8NS</td>
<td>23.95&lt;sup&gt;a&lt;/sup&gt;</td>
<td>21.94&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>6.</td>
<td>60 DNRC</td>
<td>1.0NS</td>
<td>10.85&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>9.06&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>7.</td>
<td>90 DNRC</td>
<td>1.5NS</td>
<td>4.4&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.8&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>S.E at 0.05%</td>
<td></td>
<td>4.21</td>
<td>3.49</td>
<td>-</td>
</tr>
<tr>
<td>C.D</td>
<td></td>
<td>8.42</td>
<td>6.97</td>
<td>1.05</td>
</tr>
</tbody>
</table>

DNRC - Days of nursery raised conditions; S.E – Standard Error; C.D – Critical difference: ANOVA was calculated at 0.05%; NS - Non-Significant.

**Table 2.** Effects of water imbibitions influenced by wet cloth wrapping technique on the rooting performance of mulberry (*Morus indica* L) varieties ‘Victory 1’ and ‘S36’

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>No. of Days of water treatment</th>
<th>Average no. of root per Cuttings (in numbers)</th>
<th>Average length of root per cuttings (in Cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Victory 1</td>
<td>S36</td>
<td>Victory 1</td>
</tr>
<tr>
<td>1.</td>
<td>5 days</td>
<td>1.8&lt;sup&gt;d&lt;/sup&gt;</td>
<td>4.9&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>2.</td>
<td>10 days</td>
<td>4.4&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.0&lt;sup&gt;cb&lt;/sup&gt;</td>
</tr>
<tr>
<td>3.</td>
<td>15 days</td>
<td>3.3&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>3.8&lt;sup&gt;cb&lt;/sup&gt;</td>
</tr>
<tr>
<td>4.</td>
<td>20 days</td>
<td>11.4&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>5.1&lt;sup&gt;cb&lt;/sup&gt;</td>
</tr>
<tr>
<td>5.</td>
<td>25 days</td>
<td>7.4&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>9.2&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>6.</td>
<td>60 DNRC</td>
<td>14.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.4&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>7.</td>
<td>90 DNRC</td>
<td>17.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>16.4&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>S.E at 0.05%</td>
<td></td>
<td>2.88</td>
<td>2.77</td>
</tr>
<tr>
<td>C.D</td>
<td></td>
<td>5.75</td>
<td>5.53</td>
</tr>
</tbody>
</table>

DNRC - Days of nursery raised conditions; S.E – Standard Error; C.D – Critical difference: ANOVA was calculated at 0.05%
Plate 1. Step wise development of root and shoot growth in water imbibed Mulberry cuttings influenced by wet cloth wrapping technique

Plate 2. Mulberry semi-hard wood cuttings under raised bed and rooting media (Poly bag)
Dinah and Her Experience of Sexual Assault in Genesis 34: Lessons for the Girl-Child In The Contemporary Society

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Associate Professor of Christian Education, Department of Religious Education, Baptist College of Theology, Lagos

Abstract- Growing is associated with being exposed to certain ideals that can make life meaningful, less disastrous and less painful. Sexual harassment is taken to mean the same as sexual assault in this work. This involves illegal sexual contact that involves force upon a person without the consent of that person or someone incapable of given consent based on age, physical or mental incapacity. It is often unwelcome and the one affected is not as strong as the other assaulting or harassing. The problem of sexual assault or harassment is not new as shown in Dinah’s experience in Genesis 34. Putting up with strange and unreliable persons and peers has spelt doom for many with the girl-child being severely affected and devastated. The wickedness of Shechem has continued in the world at large. However, this work intends to help the girl-child learn from the mistake of Dinah and the consequential effect on her, her family and Shechem’s family. Educating the girl-child on how to handle loneliness, who to associate with or visit, avoiding indecent dressing and lifestyles are some areas of focus. The thesis of this paper is that the girl-child with proper education and orientation can avoid repeating the mistake of Dinah but rather portray decent lifestyle and attitude.

Index Terms- Sexual Assault, Girl-Child, Experience, Lifestyle, Loneliness, Boredom and Decency.

I. INTRODUCTION

The world today is characterized with a number of indecent acts that calls for urgent attention. Such activities include theft, armed robbery, kidnapping, killings, rape, sexual assault, sexual harassment and so on. The rate at which these are happening is becoming alarming and quite disgusting (Layman, Gidycz and Lynn, 1996: 131-134). The focus of this paper is to have a look at the case of sexual assault as it relates to the girl-child with reference to the instance of Dinah in Genesis 34. The work intends to share a life story of a 15 year old girl that has an experience of sexual assault from his step father. This act has made the girl dropped from her school which invariably has caused the girl her life fortune as shall be discussed later under the case study. The girl child is often faced with a number of sexual assaults from different categories of persons such as their biological father, step father, uncles, brothers and friends of the family that are not considered to be evil in such regard sometimes (Foà & Riggs, 1995: 61-65; Wyatt, et., 1990:153-176 and White Kress, 2003:54-87 and Solomon, 2016: 83-93).

In this paper, sexual assault and harassment are presented as the same because both involve “illegal sexual contact that usually involves force upon a person without consent or is inflicted upon a person who is incapable of giving consent” (because of age or physical or mental incapacity) or who places the assailant (as a doctor) in a position of trust or authority” (sexual assault” @ e-Merriam- Webster Dictionary via Smartphone). The synonyms are assault, ravishment, rape and violation. On the other hand, sexual harassment is “uninvited and unwelcome verbal or physical behaviour of a sexual nature especially by a person in authority towards a subordinate as an employee or student” (sexual harassment” @ e-Merriam-Webster Dictionary via Smartphone). Sexual assault happens through coercion and physical force and is done without the consent of the victim. Sexual assault is happening world-wide, across gender and race and all religions have some of their members as victims (“Recommended Guidelines for Comprehensive Sexual Assault Response and Prevention …”). The girl-child is a female that is younger in age and can be considered a teenager. According to Obaja (2016: 182-185), the girl-child is from birth to eighteen years old. It is a period associated with growing and developing and should be a time of becoming educated and established. It is however unfortunate the embarrassing repeated act of sexual assault cases that are reported or revealed among this category of persons. Sometimes those involved pretend to be innocent until the case is affirmed. The girl-child is more disposed to sexual assault / harassment than the boy-child (Obaja. 2016: 186-192). The thesis of this paper is that the girl-child with proper education and orientation can avoid repeating the mistake of Dinah but rather portray decent lifestyle and attitude.

II. LITERATURE REVIEWS

This section of the research consulted other scholars on the subject of discussion with some level of interaction which also involved a true-life case study but with pseudo names to protect the identities of the persons involved.

III. DINAH AND HER EXPERIENCE OF SEXUAL ASSAULT

The story of Dinah and her sexual assault experience is recorded in Genesis 34. Dinah was the daughter of Jacob, the twin brother of Esau. The biblical record in Genesis 31:21 revealed her mother; Leah gave birth to her after having six sons
for Jacob making Leah the seventh child and the only girl in the family. Afterwards, God remembered Rachel and she had two sons, Joseph and Benjamin. The maids of Leah and Rachel also had additional sons for Jacob. Invariably, Dinah was the only girl in that home and may desire to have some time with her mates. The incidence occurred when Dinah went out to visit other women in her environment when she was sexually assaulted by Shechem, the son of Hamor the Hivite, the prince of the country. Instead of following the procedure of wooing and marrying her, he jumped on her at first sight and violated her which also means rape (Genesis 34:1-2 (NKJV).

Amazingly, Shechem did what he supposed to do first in vs 3 by speaking softly to Dinah expressing his love for her. In vs 4, Shechem spoke to his father to ask for Dinah as a wife from her father and relatives. The action of Shechem met with the anger of Jacob and his sons for the defilement of Dinah which was against the practice of the Jews. This unwelcome attitude of Shechem eventually resulted in total elimination and destruction of Shechem and his family as shown in the remaining parts of Genesis 34. Dinah is the real focus in this passage and this is because of the sexual assault she went through. Some questions that can come to mind quickly are: Why should Dinah go out to visit the women of the land? Why did she go alone? Why can’t she shout out for help and so on?

An in depth study of the passage reveals Dinah should have her freedom to move out but she was unaware that those in her community can attack her violently like that. Definitely, she was not prepared and nothing shows she gave her consent. Rather, Shechem came upon her forcefully and definitely with violence that she could not handle. While some commentators felt the action of Shechem was not a rape issue, this writer considering the words used by different bible versions such as “violated her, defiled her, humbled her, seized her, disgraced her, took her and lay with her by force etc revealed instance of sexual assault. She should be in her teen’s years at that period of the incidence and cannot have enough power, energy or strength to resist Shechem. Shechem therefore is to be blamed for all that happened then and after considering the subtle way Jacob’s children killed and exterminated Shechem’s family (Genesis 34: 5-31 NKJV).

The innocent action of Dinah by her visit to the women of the land places caution on what to watch, where to go and who to move with for the girl-child and women folk. This is because those who seem to appear as friends can eventually have evil intentions. The vulnerability of the girl-child requires that they should be watchful, sensitive and alert to scenes around that can be dangerous.

IV. CASE STUDY OF ADESEWA OLATUNDE

Adesewa Olatunde is a pseudo name for the victim of sexual assault that is narrated in this study. Adesewa is a daughter to Adebinpe who was also deceived into sexual relationship according to her story by her boyfriend who pretended to be a single man in the year 2000. The relationship led to the pregnancy of Adesewa who was born in September 2001. Adebinpe later discovered her man already had a wife with five children. She lived with the first wife, their children and her man but had to be withdrawn by her own mother because of the mal-treatment melted to her by the first wife. Adebinpe lived with her mother until she got another man who never paid her dowry until this moment of report after sixteen years of marriage (probably co-habitation because they were never married legally). Adesewa lived with her mother and her step-father and was taken care of. She grew with her mother’s siblings but Adebinpe never knew her husband has been sleeping with her daughter until four years later.

According to the pathetic story, Adebinpe’s husband deflowered Adesewa. The young girl has been warned strictly by her step father never to share the story or experience with anyone. Luck ran against the man when the girl, Adesewa narrated the ordeal when she was given serious beating because of her truancy in school. Adesewa usually leaves home for days and weeks not knowing it was her step-father that usually camp her in another rented apartment for sexual activities. She narrated how her step father bought her phone which he uses to call her and arrange for their meeting; the girl, Adesewa narrated how much pampering and gifts that she has been receiving from her step-father. Adesewa became addicted to sex to the extent that she has other boys and men outside who usually sleep with her on regular basis for a token or some gifts. As at the time of this report, Adesewa has been impregnated and it was difficult to determine who owns the baby. In fact, the person Adesewa identified as the father of her baby is another teenager of about seventeen years whose parents are still furious, angry and violent because their underground investigation made them suspected the pregnancy could have been that of his step-father.

However, because the teen boy accepted that he slept with Adesewa, the baby has been taken but the mother has gone back to her brother leaving behind about two months old baby. The pathetic story is such that the girl, Adesewa is now out of school, not in any apprenticeship relationship but has become a burden to the immediate family. The plan by her family is to make her go back to school if she cooperates with them. What a wicked act committed by her step father who exposed a child of about twelve years to early sex. As at this moment of writing, the girl is just sixteen years old and already had her first child in May 2016 (Gbadosi 2016).

V. CAUSES OF SEXUAL ASSAULT IN TODAY’S WORLD

The fact that cannot be pushed aside is that there are a number of statistics on sexual abuse, assault, harassment and rape all over the world. There is no country of the world that is immune. It is a prevalent act that is still difficult to know precisely those affected because it is not often reported. However, casual observation and underground discussions revealed many girls and women face this experience almost on a daily basis. In advanced nations, few reports as presented by the studies by David Finkelhor, Director of the Crimes against Children Research Center, show that:

- 1 in 5 girls and 1 in 20 boys is a victim of child sexual abuse;
- Self-report studies show that 20% of adult females and 5-10% of adult males recall a childhood sexual assault or sexual abuse incident;

www.ijsrp.org
• During a one-year period in the U.S., 16% of youth ages 14 to 17 had been sexually victimized;
• Over the course of their lifetime, 28% of U.S. youth ages 14 to 17 had been sexually victimized;
• Children are most vulnerable to CSA between the ages of 7 and 13 (David Finkelhor, “Child Sexual Abuse Statistics” @ https://victimsofcrime.org/media/reporting-on-child-sexual-abuse/child-sexual-abuse-statistics).

Reports of sexual assault and harassment have continued to be a form of threat to the girl child from those who are not too far from them. Those who assault them are sometimes relatives, friends, colleagues and neighbours. Persons who endanger them through sexual assault are not considered suspects initially because they often pretend to be nice to their victims. Sexual assault therefore occur in homes, or that of relatives, in a car, at a party, club, or other gathering, school, workplace, doctor’s office, or personal office of the one who did the assault (Frazier, 2000: 204). Many girls and women cover up their experiences of sexual assault because of shame which ordinarily should not be. Opening up by victims helps counselors, parents, medical practitioners and others who care. It is unfortunate that despite measures put up many years ago to eliminate and reduce sexual assault; it has continued to be a reoccurring incidence. The girl-child is expected to be at alert to recognize signs that can lead to sexual assault and flee such persons or environment. In addition, the girl—child and younger girls generally should avoid deliberate involvement in early sexual activities (Onaolapo, 2016:117-130). Few causes of sexual assault and harassment include:

Lack of godly training and modeling- Younger girls who are exposed to rough and ungodly lifestyles are usually prone to sexual assault. As at the time of this research, two girls knocked at the door of the researcher and asked for help. Upon some inquiry, the ladies said their mother died some years ago and their father who has three wives is not taken care of them. The older one is about sixteen or eighteen years, she already had a baby and is not with the man that impregnated her. According to the story of the older one, five of them are living with their grandmother who could not provide adequately for their meals resulting in begging around. Girls in similar situation are often exposed to sexual activities too early and too soon according to Onaolapo (2016:117-130) and such reveals the home is weak in appropriate training and modeling.

Ungodly company and visitation- The age of civilization and freedom make some girls to move out freely and sometimes without restriction. Those unfortunate have become prey in the hands of wicked and violent men who have no restriction when it comes to the issue of sex. Continuous association with ungodly people will mar the future of young girls when early prevention and caution are not introduced. Visiting indiscriminately is also very dangerous and harmful for younger girls. There are reports of kidnap; ritual acts on daily basis to the extent that even when a girl-child is not raped could become victim in the hands of ritualists and this also call for needed caution.

Covetousness of the girl-child- We live in a world that is engrossed in materialism. Many girls who are not very disciplined are sometimes enticed by gifts that are considered prey from those who afterwards molest the girl-child. Insatiable appetites for food, clothes, shoes and some other lady stuff can lure such girls into the hands of those who will sexually assault them. Some in-disciplined girls in primary, secondary and higher institutions are known for such acts. When this happens, the greediness and covetousness of the girls are considered the major cause of sexual assault.

Reckless and indecent lifestyle- Today, reckless and indecent lifestyles are in vogue. These are considered being fashionable, knowledgeable and civilized. On the contrary, there is nothing good that comes of such attitude and way of life. Girls who live reckless and indecently have stories of regret, pains, cry, agony and frustration especially when they are dumped by those they think have flair for them. Lack of self-discipline on the part of the girl-child and inability to resist what is not ideal will bring trauma. Instead, learning to have satisfaction with the little parents and guardians can offer will be helpful. Barna (2001: 21-44) revealed that the younger generation are combatting with numerous lifestyles and influences that are sometimes negative. Such are the influences of media, peer groups, musical preferences and internet etc.

Impact of Media- Social media, television, movies, sexy and worldly songs – the exposures that are impacting all children from media are too numerous to mention. Adversely, the girl-child has been tempted to attempt trying what is seen in the movies, on T.V and worldly songs. Those who have not been too disciplined to say no to some enticements are already victims and will remain preys in the hands of those who have the tendency of assaulting them (“Violence against the Girl Child” @ http://www.stopvaw.org/violence_against_the_girl_child...”; Barna, 2001: 21-44).

VI. TOWARDS AVOIDING THE TROUBLE OF SEXUAL ASSAULT

Love God and the holiness attached to the knowledge of God- The Christian experience is such that younger girls are to be brought up in the way of the Lord. Deuteronomy 6: 4-9 known as the Shema has enough direction on bringing up the younger generation (male and female) in the way of God. Teaching growing girls and boys to love and fear God has the tendency of helping them flee all appearances of evil (Ayanrinola, 2013: 205-208).

Avoid ungodly peer influence and company- Dinah was in the wrong place at the wrong time. Younger girls are expected to watch where they go and who they moved with because such carelessness can spell doom for the life of the victim (Genesis 34:1). Many age mates of young girls can serve as traps and should be avoided as much as possible by the girl-child. In addition, ungodly peers that can make life miserable are not to be pitched tent with for any reason.

Speak with your parents on sexual assault experience early enough- In the case of Adesewa as narrated above, the case could not have become worsened if the girl had been educated earlier to speak out her experiences. Contrary, her quietness and supposed secrecy destroyed her life except she determined to rewrite her own life story. There are many girls outside there who are victims of sexual assault in the hands of those very close to them. Ayandokun (2013: 157-166) advises parents on guidelines www.ijisrp.org
that can be adopted in overcoming negative peer group influences.

Call for help where possible - Girls and younger ladies are to be educated and given needed orientation to shout and cry for help when traits of sexual assault are perceived or apparent. There could be someone very close who can be of help which the girl-child can call on. In instances where the life of a child is threatened, once beaten should not be allowed to happen again. The girl-child deserves to be protected to become greater persons in the nearest future (“The Worth of a Girl-Child” Proclaim, 2016: 25-27). Use Joseph’s style of fleeing - Genesis 39 revealed the story of Joseph and his experience with his master’s wife, Potiphar. Specifically, Potiphar’s wife had interest in Joseph; upon his refusal, the woman wanted to force him to bed. The quick and smart response of Joseph was by fleeing. This single act brought pain to Joseph but the story revealed God eventually vindicated Joseph. The style of fleeing as much as possible is often encouraged if possible (Genesis 39: 1-23 NKJV). An in-depth youth ministry has the capacity to orientate younger ones on appropriate attitude to sex as seen in Joseph’s style (Oyelade, 2012: 9-12).

Report Cases or Instances of Sexual Assault - since most of sexual assault comes from people who are friendly, familiar and are sometimes relatives reveal the reason why the cases or instances call for being reported so that such reports will help in designing strategies for others not to become victim of sexual assault (“Sexual Assault: What Every Girl Should Know…” @ http://www.sackington.com…). Koss, Mary and Mary Achillies citing Coker, (2004: 1331-1353) revealed that perpetrators could also be provided with restorative justice with the hope that they will not continue in such acts. This concept is biblical and in line with Jesus’ response to the woman caught in adultery in John 8: 1-11 when Jesus asked the woman to go and sin no more. Educate the girl-child on appropriate sex life – Okpara (2015) affirm that,

There is also the issue of safety and security in schools; girls tend to suffer violence. From ages 15 and 24, about one out of every three girls have suffered violence one way or the other, either through sexual harassment, rape or incest. So it is important for the government to address the issue of sexual education, provide incentives for girls to complete in primary and secondary schools.

Here, the role of parents, pastors, teachers, adults & counselors are considered without excluding the role of the government. While both genders can experience the trouble of sexual assault, the girl-child is more vulnerable than the boy-child. As the girls grow in homes, churches, schools and in the community, they need to be taught and enlightened on what to watch and signs to identify to avoid inappropriate sex experience. This can also be made possible by proper education and orientation (Garland, N. D: 1-20). Parents, pastors, teachers and people who protect the girl-child should not fold hands in this regard and some other issues concerning the girl-child worldwide (“Attitude toward a Girl-Child” 2016: 24-25). VII. EDUCATING THE GIRL–CHILD TO LEARN FROM THE EXPERIENCE OF DINAH

There is urgent need to provide a kind of orientation for the girl-child on appropriate lifestyles that reduces sexual assault. The story of Dinah revealed she visited with the women of the land which probably showed she did not know them very well. They are not people to be trusted because the story did not reveal their attempt to protect her despite the fact that she went out to visit them. Moving out in a wrong dimension has negative consequences. Ordinarily, supposed freedom that Dinah thought she could have landed her in disgrace, shame and unnecessary sexual assault. As a virgin, she was violated and assaulted bringing humiliation to her family. Any movement or association that can lead to harassment should be avoided by all persons but most especially by the female persons and the girl-child in the context of this research. Ayanrinola advised that providing early and adequate nurture for the younger girls and even boys are helpful to build godly foundation and the walls of the life of each child from evil predators (Ayanrinola, 2013:199-204).

A girl-child should be given needed orientation that instead of being home property, she can become valued, cherished, make informed decisions about her life, career, who to marry and what to become in life. Dinah made a wrong choice though she is not to be blamed 100% for the calamity that befell her but shared in that scene because of her action which was not considered appropriate. The story did not reveal she took any permission; maybe she could have been escorted by one of her siblings. This is a lesson for the girl-child to reduce walking alone especially in places not considered secure. Loneliness should also be handled wisely as much as possible. Keeping watchful eyes on the environment and the types of persons around can save the girl–child sometimes from unnecessary sexual assault (Young, 2014: 62-92).

Dinah was violated against her wish and desire. Her cherished virginity was tampered with. There are many ladies who have had such brutal experiences; some were able to overcome the trauma because of persons around them who provided support, succor, encouragement and hope that life still worth’s it after all. Many others having been traumatized could not make meaning out life. Some eventually developed emotional distress that destroyed their life’s ambitions and careers. We live in a world where sex is considered as fun even when it does not involve assault. Many young girls who are expected to keep themselves pure have allowed men to violate them for ephemeral things. Though this was not the story of Dinah but the experience should make the girl-child avoid actions that can lead to their being violated sexually. Providing effective teaching on how to live will help the girl-child become fulfilling and goal-oriented (Horton, 1992:15-30).

VIII. RESEARCH ELABORATIONS

The researcher in an attempt to test the research topic empirically sent out 100 questionnaires shared among teenagers and youths during teens’ and youth program at Victory Baptist Church, Owu, Agbowa, Lagos State, Nigeria on March 16th, 2017, among selected pastors in Baptist College of Theology, Lagos and members of Baptist churches in selected sections of Lagos State, Nigeria. This was done through simple random
sampling. A total of 84 questionnaires were returned which gave 84% that is considered reliable to analyze. The respondents were female and male teenagers, youths and adult males and females. The biographical tables were considered not necessary in this type of research. However, from the questionnaires, the tables drawn were on, Understanding the Concept of Sexual Assault or Harassment, Problems Emerging from Sexual Assault or Harassment, Causes of Sexual Assault or Harassment, Strategies to Deal with Sexual Assault or Harassment and Educating the Girl – Child to Learn from the Experience of Dinah.

Table 1: Understanding the Concept of Sexual Assault or Harassment

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<td>1.19%</td>
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<td>42</td>
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<td>8.33%</td>
<td>8.33%</td>
<td>84</td>
</tr>
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<td>It is also an uninvited and unwelcome verbal or physical behaviour of a sexual nature especially by a person in authority towards a subordinate as an employee or student.</td>
<td>30</td>
<td>42</td>
<td>5</td>
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<td>35.71%</td>
<td>58.33%</td>
<td>1.19%</td>
<td>1.19%</td>
<td>84</td>
</tr>
</tbody>
</table>

Table 1 reveals a larger percentage of the respondents understand the concept of sexual assault and harassment. This is an indication that it is a recurrent experience world-wide. It therefore calls for an appropriate response.

Table 2: Problems Emerging from Sexual Assault or Harassment

<table>
<thead>
<tr>
<th>NO</th>
<th>Statements</th>
<th>A</th>
<th>SA</th>
<th>D</th>
<th>SD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Those affected can have their lives caught short by untimely death.</td>
<td>42</td>
<td>37</td>
<td>5</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50%</td>
<td>44.05%</td>
<td>5.95%</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Those affected can be endangered by contacting STDs.</td>
<td>25</td>
<td>56</td>
<td>1</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>29.76%</td>
<td>66.67%</td>
<td>3.57%</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Having unwanted pregnancy can cause dropping out of school.</td>
<td>32</td>
<td>50</td>
<td>2</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>38.10%</td>
<td>59.52%</td>
<td>2.38%</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>The molestation can cause pain, disgrace and defilement.</td>
<td>21</td>
<td>62</td>
<td>1</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>25%</td>
<td>73.81%</td>
<td>1.19%</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The experience is dangerous</td>
<td>28</td>
<td>50</td>
<td>6</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>33.33%</td>
<td>59.53%</td>
<td>7.14%</td>
<td>84</td>
<td></td>
</tr>
</tbody>
</table>
for the health of both involved.

Table 2 reveals that there are unpleasant consequences attached to persons who are victims of sexual assault and harassment. This understanding places caution on appropriate way to guide against this among all age groups because of its irreversible experiences.

Table 3: Causes of Sexual Assault or Harassment

<table>
<thead>
<tr>
<th>NO</th>
<th>Statements</th>
<th>A</th>
<th>SA</th>
<th>D</th>
<th>SD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Lack of godly training and modeling.</td>
<td>29</td>
<td>49</td>
<td>4</td>
<td>2</td>
<td>84</td>
</tr>
<tr>
<td>12</td>
<td>Ungodly company and visitation.</td>
<td>37</td>
<td>44</td>
<td>3</td>
<td>5.57</td>
<td>84</td>
</tr>
<tr>
<td>13</td>
<td>Covetousness of the girl-child on material acquisition.</td>
<td>40</td>
<td>39</td>
<td>5</td>
<td>5.95</td>
<td>84</td>
</tr>
<tr>
<td>14</td>
<td>Reckless and indecent lifestyle as seen in dressing and outing etc.</td>
<td>38</td>
<td>43</td>
<td>3</td>
<td>3.57</td>
<td>84</td>
</tr>
<tr>
<td>15</td>
<td>Impact of Media-Social media, television, movies, sexy and worldly songs.</td>
<td>35</td>
<td>41</td>
<td>8</td>
<td>9.52</td>
<td>84</td>
</tr>
<tr>
<td>16</td>
<td>Putting up with ungodly peers and friends who can lure them.</td>
<td>34</td>
<td>48</td>
<td>2</td>
<td>2.38</td>
<td>84</td>
</tr>
<tr>
<td>17</td>
<td>Lack of caution from parents and older adults on issue of premarital sex.</td>
<td>42</td>
<td>37</td>
<td>5</td>
<td>5.95</td>
<td>84</td>
</tr>
</tbody>
</table>

Table 3 reveals a variety of causes of sexual assault and harassment out of which many are self-inflicted. This shows that some of these causes when avoided can reduce cases of sexual assault and harassment to the barest minimum. Parents, guardians and older adults can be of great help in teaching against indecent lifestyles and behaviors.

Table 4: Strategies to Deal with Sexual Assault or Harassment

<table>
<thead>
<tr>
<th>NO</th>
<th>Statements</th>
<th>A</th>
<th>SA</th>
<th>D</th>
<th>SD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Love God and the holiness attached to the knowledge of God.</td>
<td>32</td>
<td>52</td>
<td>61.90%</td>
<td>2.38%</td>
<td>84</td>
</tr>
<tr>
<td>19</td>
<td>Avoid ungodly peer influence and company.</td>
<td>28</td>
<td>56</td>
<td>66.67%</td>
<td>2.38%</td>
<td>84</td>
</tr>
<tr>
<td>20</td>
<td>Girls should speak with their parents on sexual assault experience early enough.</td>
<td>25</td>
<td>59</td>
<td>70.24%</td>
<td>2.38%</td>
<td>84</td>
</tr>
<tr>
<td>21</td>
<td>Girls should call for help where possible.</td>
<td>33</td>
<td>49</td>
<td>58.33%</td>
<td>2.38%</td>
<td>84</td>
</tr>
<tr>
<td>22</td>
<td>Use Joseph’s style of fleeing once you sense danger.</td>
<td>26</td>
<td>56</td>
<td>66.67%</td>
<td>2.38%</td>
<td>84</td>
</tr>
<tr>
<td>23</td>
<td>Report Cases or Instances of Sexual Assault.</td>
<td>33</td>
<td>51</td>
<td>60.71%</td>
<td>2.38%</td>
<td>84</td>
</tr>
<tr>
<td>24</td>
<td>Educate the girl-child on appropriate sex life.</td>
<td>31</td>
<td>52</td>
<td>61.90%</td>
<td>1.20%</td>
<td>84</td>
</tr>
</tbody>
</table>

Table 4 attempts to suggest strategies that can be adopted to deal with cases of sexual assault and harassment. Those suggested are accepted with high ratings by the respondents which revealed they are considered helpful. All who have opportunities to deal with the girl-child should continue to give needed care and guidance to deal with this menace.
Table 5: Educating the Girl–Child to Learn from the Experience of Dinah

<table>
<thead>
<tr>
<th>NO</th>
<th>Statements</th>
<th>A</th>
<th>SA</th>
<th>D</th>
<th>SD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Provide orientation for the girl-child on appropriate lifestyles that reduces sexual assault.</td>
<td>29</td>
<td>54</td>
<td>1</td>
<td>1.19</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34.52%</td>
<td>64.29%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Avoid putting up with people you cannot trust or do not know.</td>
<td>29</td>
<td>55</td>
<td>1</td>
<td>1.19</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34.52%</td>
<td>65.48%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Avoid misuse of freedom where such exist because of its repercussion.</td>
<td>39</td>
<td>43</td>
<td>1</td>
<td>1.19</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>49.43%</td>
<td>65.48%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>28</td>
<td>Avoid ungodly association with bad peer groups/unbelievers.</td>
<td>33</td>
<td>51</td>
<td>1</td>
<td>1.19</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>39.29%</td>
<td>60.71%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Providing early and adequate nurture for the younger girls and boys are helpful to build godly foundation.</td>
<td>36</td>
<td>48</td>
<td>1</td>
<td>1.19</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>42.86%</td>
<td>57.14%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>A girl-child should be given needed orientation to become valued, cherished, make informed decisions about her life, career, who to marry and what to become in life</td>
<td>26</td>
<td>58</td>
<td>1</td>
<td>1.19</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30.95%</td>
<td>69.05%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5 provided additional options on what the girl-child should take note and avoid in order not to become victim of sexual assault and harassment. The responses gave high support for the suggestions.

IX. CONCLUSION

This paper has presented sexual assault and sexual harassment to mean the same. Both have the tendency of force sexual relationship most common with younger girls called the girl-child in this study. The case of Dinah was examined to serve as warning for younger generation on appropriate company and movement. The paper shared true life story of Adesewa who was violated at age twelve and for about four years before it was known by the mother. The paper also presented some causes of sexual assault, towards avoiding the trouble of sexual and educating the girl-child to learn from the experience of Dinah and the conclusion. From the work, it is obvious that the girl-child is more vulnerable to sexual assault compared to their male counterparts.

REFERENCES

10. The Holy Bible.
20. “Sexual assault and Sexual Harassment” @ e-Merriam- Webster Dictionary via Smartphone.


AUTHORS

First Author – Dr Esther O. Ayandokun has been in the teaching profession for close to three decades. She holds a Doctor of Philosophy in Educational Administration from the Nigerian Baptist Theological Seminary, Ogbomoso, Oyo State, Nigeria in 2006. She received further training and post-PhD exposure at SWBTS, Forth-Worth, Texas and Dallas Baptist University, Dallas, USA in 2011. She has authored some books and published in learned journals. She is also a conference speaker and facilitator. She lectures presently at Baptist College of Theology, Lagos, Nigeria having served in various academic and administrative positions. She is a member of some learned academic bodies such as the National Association for the Study of Religions and Education; International Council for Higher Education; Society of Professors in Christian Education (SPCE), USA and some others. She is presently an Associate Professor in Christian Education.

APPENDIX: SAMPLE QUESTIONNAIRE ON DINAH AND HER EXPERIENCE OF SEXUAL ASSAULT IN GENESIS 34: LESSONS FOR THE GIRL-CHILD IN THE CONTEMPORARY SOCIETY

Introduction

I bring greetings to you in the name of our Lord and Saviour Jesus Christ and pray that the abundant grace of God remain sufficient for you. Amen. I humbly request that you spend few minutes now to please quickly respond to this questionnaire. Doing that is greatly appreciated and it shows your commitment to the subject above. The information provided is for research purpose and the result will assist in providing right guidance for the girl-child in the contemporary society. You are an instrument that God will use. Amen. Thanks and God bless you.

Humbly Yours in Christ,
Ayandokun, Esther O.
0802-6232-822

NOTE: Please return this to the usher or the researcher today, do not take home please.

Section A: Biographical Data:

Name: (Optional): __________________________________________
Gender: _____Are you single or married? (underline) _______________________
Age Range: (Approximate): _________________________________________

SECTION B: Read through the statements below and tick your conviction using (√) SA= Strong Agree; A= Agree; D= Disagree and SD= Strongly Disagree.

<table>
<thead>
<tr>
<th>S/N</th>
<th>STATEMENTS</th>
<th>A</th>
<th>SA</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Understanding the Concept Sexual Assault or Harassment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>It involves illegal sexual contact that involves force upon a person without the consent of that person.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>It is often unwelcome and the one affected is not as strong as the other assaulting or harassing.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>It is also an uninvited and unwelcome verbal or physical behaviour of a sexual nature especially by a person in authority towards a subordinate as an employee or student.</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Sexual assault is happening world-wide, across gender and race and all religions have some of their members as victims.</td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>Putting up with strange and unreliable persons and peers has spelt doom for many with the girl-child severely affected and devastated</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>B</td>
<td>Problems Emerging from Sexual Assault or Harassment</td>
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<tr>
<td>6</td>
<td>Those affected can have their lives caught short by untimely death.</td>
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<td>7</td>
<td>Those affected can be endangered by contacting STDs.</td>
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<td>8</td>
<td>Having unwanted pregnancy can cause dropping out of school.</td>
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<td>The molestation can cause pain, disgrace and defilement.</td>
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<tr>
<td>10</td>
<td>The experience is dangerous for the health of both involved.</td>
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<td></td>
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<td>C</td>
<td>Causes of Sexual Assault or Harassment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Lack of godly training and modeling</td>
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<tr>
<td>12</td>
<td>Ungodly company and visitation</td>
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<td>Covetousness of the girl-child on material acquisition</td>
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<td>13</td>
<td>Reckless and indecent lifestyle as seen in dressing, outing etc.</td>
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<td>16</td>
<td>Lack of caution from parents and older adults on issue of premarital sex.</td>
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<td><strong>D Strategies to Deal with Sexual Assault or Harassment</strong></td>
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<tr>
<td>23</td>
<td>Report Cases or Instances of Sexual Assault.</td>
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<td>Educate the girl-child on appropriate sex life.</td>
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</tr>
<tr>
<td></td>
<td><strong>E Educating the Girl –Child to Learn from the Experience Of Dinah</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Provide orientation for the girl-child on appropriate lifestyles that reduces sexual assault</td>
<td></td>
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</tr>
<tr>
<td>26</td>
<td>Avoid putting up with people you cannot trust or do not know.</td>
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<tr>
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<td>29</td>
<td>Providing early and adequate nurture for the younger girls and boys are helpful to build godly foundation.</td>
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<td>30</td>
<td>A girl-child should be given needed orientation to become valued, cherished, make informed decisions about her life, career, who to marry and what to become in life.</td>
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</tbody>
</table>

**Add other comments:**
FACTORS GOVERNING THE DESIGN ASPECTS OF SUSTAINABLE BUILDING IN DIFFERENT CLIMATIC ZONES

K.Kirubakaran*, Dr.K.Murali**

*PG student, Department of civil engineering, Sri Ramakrishna Institute of Technology, Coimbatore, India.
** Professor, Department of civil engineering, Sri Ramakrishna Institute of Technology, Coimbatore, India.

Abstract- A structure is essentially a modifier of microclimate; the space is isolated from humidity fluctuations and climate temperature sheltered from precipitation, prevailing winds and with an enhancement of natural light. We are ignoring the environment in today’s age of urbanization, it leads to an environmental imbalance and mainly the construction industry plays massive role in this. The resources are wasted and pollution is created, during and after the construction process due to faulty planning. The sustainable building design provides solutions to above mentioned problems. It makes the environment green and clean. The sustainable building will minimize the demand of usage on non-renewable resources and maximize the recycling, utilization of renewable resources and reuse. By understanding the factors, techniques and design that governs the sustainable building, we can construct the sustainable building which will consume the resources without compromising the future needs. The minimization of mechanical appliances for lighting and ventilation purpose, minimization of resources and prediction of the solar radiation for the existing or newly constructed buildings is explained in this article which will be helpful for the design and construction use.

Index Terms- Sustainable Building, Climatic Zones, Modeling, Radiation

I. INTRODUCTION

According to Giaccardo, (2004) the green design is defined as a planning and construction which will eliminate or reduce the negative impact of buildings on occupants and environment in five areas namely sustainable site planning, energy efficiency and renewable energy, safe guarding water and water efficiency, indoor environmental quality and conservation of materials and resources [1]. Sustainable building will reduce the natural resources to the least possible during its operation and construction. This paper explains about the maximum usage of efficient building materials and construction process, equipments to meet air-conditioning, lighting with minimum power consumption and use of the renewable energy. By this we can achieve comfortable, pleasant and conductive structures that ensure psychological and physiological comfort to the occupants in the buildings.

II. KEY PRINCIPLES ASSOCIATED WITH GREEN BUILDING DESIGN

The key principles associated with the green building design are sustainable site design, water conservation and quality, energy and environment, indoor environmental quality, conservation of materials and resources [2].

Sustainable site design: Site analysis is carried out to break down the site in to basic parts, to isolate an areas and the systems requiring protection and also to identify the on-site and off-site factors that may require modification. It includes the identification of soil types and its properties and slope orientation [3]. It also minimizes the urban sprawl, unnecessary destruction of valuable land, green space and habitat, which result from the incompetent low density development. Encourage the higher density urban development, urban renewal, urban re-development and brown field development as a means to preserve the valuable green space [2].

Water conservation and quality: Emphasis must place on on-site filtration, retention on storm water and ground water recharge using techniques that closely match natural systems. Reduce the needless usage of potable water on the site. Maximize the reuse and recycling of water, including storm water, harvested rain water and grey water [2]. The waste water that comes from cloth washers, baths and showers is called grey water and can be irrigated through sub-surface irrigation. The sub-surface distribution systems used are Evapotranspiration systems, shallow trench and shallow mound [4].

Indoor environmental quality: Provide a design for building which gives good ventilation, indoor air quality, thermal comfort access to day lighting and natural lighting and effective control of acoustical environment [2].
**Energy and environment:** Reduce adverse effect in the environment by optimized building design, optimized building siting, and aggressive usage of energy conservation measures and material selection [2]. The consumption of energy in the building can be reduced by adopting new equipment’s and techniques instead of using conventional equipment’s for domestic works such as solar water heater, solar lantern, use of biogas etc. [4].

**Conservation of materials and resources:** Green building materials are made of renewable resources instead of non-renewable resources and also result in low maintenance and replacement cost throughout the life of a building. The materials should be zero or low toxic content, highly recyclability, longevity, durability and local production [5]. Utilization of highly recycled contents material in the structure and the finishes will minimize the waste disposal. Encourage blended concrete using slag, fly ash, recycled concrete aggregate and further admixtures to recycled content materials such as ceiling and floor tiles, structural steel, carpet padding, gypsum wallboard and sheathing will conserve the resources [2].

### III. TECHNIQUES USED FOR SUSTAINABLE DESIGN

#### 3.1 ADVANCED PASSIVE HEATING TECHNIQUES

The techniques used for sustainable building design to achieve thermal comfort in the cold climate are classified into direct gain, indirect gain and isolated gain systems.

##### 3.1.1 Direct gain system

The commonly used system is termed as direct gain system. In the living space the radiant heat directly shines through the south facing windows and it was absorbed by a thermal mass. Here the building itself act as some storage devices for the heat. Then the heat will be re-radiated from the buildings (inner walls/ floors) core and heat (outer walls and air) interior space during the night [7].

##### 3.1.2 Indirect gain system

The water wall, trombe wall, mass wall and roof pond are an indirect gain system that combines a collection, storage and the distribution functions within some parts of building envelope, which encompasses the space [10].

**Trombe and water wall**- Trombe wall is a thermally massive wall provided with vents at the top and bottom. The outer surface of the wall is usually painted black for maximizing absorption and the wall will be placed behind glazing with an air gap in-between. The air in the space between the wall and glazing gets heated up and enters living space by convection through the vents. Solar radiation is stored as sensible heat by the wall. The vents are closed during night and heat stored in the day time heats the room by conduction and radiation. The water wall will work same as trombe wall except they employ water as the thermal storage material. This is a thermal storage wall made of drums of water stacked behind glazing and they are painted black to increase absorption. Heat transfer is more in the trombe wall. Main disadvantage is this method needs more amount of water [6].

**Roof based air heating system**- In this the incident solar radiation are trapped by the roof and used for heating the interior spaces. Between the insulation and roof, an air pocket is formed, which is heated by the solar radiation. The moveable insulation can also use to minimize heat loss during night by glazing panes [6].

##### 3.1.3 Isolated gain systems

**Sunrooms**- Sunrooms are constructed using overhead or sloped glass. A thermal wall on back of the sunroom against the living space will work as an indirect gain thermal mass wall. By this, the additional heat can be brought into the room via low and high vents like an indirect gain thermal wall [8].

#### 3.2 ADVANCED PASSIVE COOLING TECHNIQUES

##### 3.2.1 Ventilation and wind tower

For ventilation the air movement is created by outdoor breezes through the interior of the house by the “push-pull effect of negative pressure on the leeward side and positive air pressure on the windward side. In wind tower, the hot air will enter the tower through the openings in the tower, they will get cooled and become heavier and they sink down. The tower wall will absorb the heat during daytime and release it during night time, thus warming the cool night air in the tower [6].

##### 3.2.2 Evaporative cooling

Evaporative cooling is employed to improve the thermal comfort in the structure. The direct evaporative cooling is introduced into the conditioned space air that is exposed to liquid water. There is a conversion of sensible to latent heat by evaporation at a constant wet bulb temperature, so the air supplied is not only in cooler condition, but also humid. Indirect evaporative cooling minimizes the air dry bulb temperature without increasing its moisture content: that the air supplied to a conditioned space will be fed into the heat exchanger that will contain water or air that has been separately cooled by a direct evaporative cooler [11].

In courtyards from the ground level the cool air flows through louvered openings of foams surrounding the courtyard, hence produce air flow [6]. At the depth of 4m below the ground level, a earth air tunnel is fixed which is in the form of pipe, so an ambient air ventilated through the tunnel will get warmer in winter and cooler in summer [6].
IV. DESIGN FOR VARIOUS CLIMATIC ZONE

4.1 Design aspects for Hot-Arid Zone

Grid diagonal to east west axis: The grid pattern maximizes radiation throughout its straight streets, but by orienting the grid pattern diagonally to the east-west axis, the sun exposure and shade is better distributed on the streets, such a grid still supports the dynamic movement of air [5].

Narrow, zigzagging alleys: Winding or zigzagging narrow alleys receive minimum radiation, reduce the effect of stormy winds, establish shaded spaces throughout the day which provide a cool and comfortable microclimate and also stay relatively warm during cold nights and in winter [5].

Blocked streets and alleys: Street orientation and the housing patterns are significant and should be planned carefully. Straight and parallel streets open the city to wind ventilation. Storm effects can be reduced by blocking streets. Two-storey buildings with a closed patio open to the sky will minimize radiation, maximize shade, yet still retain ventilation and reduce the effects of stormy winds. Buildings should be attached (cluster) to reduce exposed surfaces [5].

Fig.4.1 (a) Grid diagonal to east west axis  Fig.4.1 (b) Zigzagging alleys  Fig.4.1 (c) Blocked streets

4.2 Design aspects for Warm Humid Region

To provide sufficient air circulation, buildings should be scattered and have a low population density. Buildings should be separated with large, free spaces between them. This allows airflow, which provides ventilation for hygienic environment and cooling.

Sun orientation: Settlements should place on northern or southern slopes that are facing away from equator. So north and south slopes will receive less radiation than east and west slopes.

Room arrangements: The Bedrooms can be adequately located on the east side, where it is coolest in the evening. Good cross-ventilation is especially important for these rooms because, at rest, the human body is more sensitive to climate. On the other hand, the stores and other auxiliary spaces can be located on the west side.

Kitchen: The kitchen is mainly used during morning and midday hours; it can be located on the west side as well.

Main room-The main rooms which are in use most times of the day, such as living rooms, should not be located on the east or west side.

Rooms with internal heat load: Rooms where internal heat occurs, such as kitchens, should be detached from the main building, although they can be connected by a common roof.

Wet Rooms: Special attention should be given to the arrangement of rooms with a high humidity (bathrooms). Here a proper cross-ventilation is especially important to avoid mould growth.

Cross-ventilation: The high humidity and warm temperatures require maximum ventilation, which leads to very open buildings. This is valid not only for the design of the elevations, but also for the floor plan.

4.3 Design aspects for Temperate and Upland Zones

To resist the heat gain, the exposed surface area to be decreased by proper shape and orientation of the building. To increase the thermal resistance roof insulation should be done on west and east walls. The shading to be increased in east and west walls, if there is a glass window it can be protected by overhanging roof and shading can be provided by trees and fins. To promote heat losses provide exhausts and windows. The air exchange rate is increased by arrangements of openings and courtyards.

The orientation of building must be faced on south direction. The form will depend on the precipitation patterns. In winter there must be a heat gain and in summer there must be a shade for the building. The ventilation provided also is in a controllable condition. The building must be in elongated shape towards the east-west axis. For the utilization of winter sun, the southern front can properly have designed and also there will be protection from summer sun. the windows can be placed along the eastern side to receive the heat in the morning time, which will more valued in winter time. In west side, the large windows should be avoided; if not the incoming solar heat gain will coincide with the greater air temperature.

V. MODELING

In sustainable buildings, orientation is a major design aspect, mainly regard to solar radiation, daylight, and wind. The orientation of the building should be based on whether cooling or heating is predominant requirement in the building. The amount of solar radiation
falling on the surface varies with orientation. The modeling was carried out using Autodesk Ecotect Analysis software for three climatic conditions namely, warm humid climate (Chennai), hot arid climate (Jodhpur) and temperature climate (Bangalore). The solar radiation chart for various regions along all four directions namely orientation along North, East, South and West were prepared and presented in Fig. 4.2 to Fig.4.4 respectively.
From the solar radiation charts it was observed that, in India building oriented towards north-south are preferred. South orientation receives a maximum radiation during winters, which is preferable for India condition. East and West receives maximum radiation during summer, West orientation will have maximum solar radiation during evening which is more crucial climate.

VI. CONCLUSION

The sustainable building design was carried out to achieve comfortable, pleasant and conductive structures that ensure psychological and physiological comfort to the occupants in the buildings. It was observed that north-south orientation is preferred for Indian climatic conditions.

REFERENCES

AUTHORS

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Validating Locus of control and Its Relation to Knowledge about Ecosystem Based on Students Gender: A Comparative Analysis

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Abstract - Education has a vital role in development of any country in the world. Part of it is teaching and learning process which involving two very basic actors, teachers and students. It has been admitted that the success or fail of human development determined by their personality. This is a trait which will influence human behavior. One of the important aspects of human personality, according to some of Organizational Behavior text books, is called locus of control (LOC) which its measurement initiated by Rotter (1978), but for Indonesian students still need to be validated. Theoretically, it determines knowledge, then indirectly affect on behavior (Blaikie, 1993). How to develop and validating LOC instrument and its relation to student’s knowledge about ecosystem based on students gender is the objective of this study. Therefore, a survey method has been conducted in three different big cities, Palembang, Jakarta, and Makassar which involving senior high school students with total n = 362. Some LOC indicators developed based on its conceptual definitions, with two-forced choice item (17 items) by 2-1 scores. Student’s knowledge about ecosystem instrument consists of 17 items as well with “true-false choices.” Research results reveal that there is no significant difference between male and female students LOC and knowledge about ecosystem. Only one item of LOC is not valid and all knowledge items are valid. Reliability of LOC instrument is .705, but low reliability found on knowledge, .402. These findings come up with conclusion that students LOC could be validated empirically and students LOC could be used to predict students’ knowledge about ecosystem, both for male and female students which supposed to, finally, determine students responsible behavior in facing environmental issues.

Keywords: Locus of control, two-forced choice, validity, and reliability

I. INTRODUCTION

Human ignorance is one of human weaknesses where education has a vital role to eradicate such kind of people sickness. It tends to be one of barriers when development tried to be achieved its goals effectively. Hence, in a small step, teaching and learning would be beneficial in overcoming human ignorance. Therefore, human knowledge would be strengthened by teaching and learning at school in preparing students to face any problems in society, especially students attitude and behavior toward environmental issues or ecosystem (Putrawan, 2014). It could be influenced by one of personality aspects, such as locus of control which hypothetically determine human knowledge and finally affect directly to human intention to act dealing with human responsible environmental behavior (in Hines, et.al.1986, modified by Blaikie, quoted by Putrawan, 2014).

Related to knowledge, Hegel stated that scientific knowledge and human thinking in general, is a change process from Think-In-Itself, into Think-For-Us, from the nature of materials into something useful for us. It means that what has been not understood at one stage will be explainable. Bloom (1981) then described that knowledge involved the description about situation focusing on recalling about ideas, objects and other phenomena. Based on its aspects, He also classified knowledge into three groups (1) knowledge about facts and terms, (2) knowledge about problem solving which consist of knowledge about classification, methods, categorical, trends, etc. and (3) knowledge about principles, theory and criteria.

Anderson and Krathwohl (2002) have contributed in developing new dimensions which they called as “a cognitive process.” It consists of (1) knowledge about fact (2) knowledge about concepts; (3) knowledge about procedural, and (4) metacognitive knowledge. Structurally, it is close to what has been developed by Bloom (1981), but analytical and synthesis pattern of thinking have been integrated into analytical thinking and they put final process with what they called “creation.”

Related to this study, knowledge about ecosystem is one of the variables, therefore, knowledge about ecosystem means all things that relevant to ecosystem concepts which consist of food chain concepts, energy, limiting factors, and biogeochemical cycles. Based on definition as define by Odum (2005), ecosystem is an interrelated and interaction among abiotic and biotic components in natural or artificial system, functionally and structurally. Those components are inseparable because if one component be destructed, then it would be followed by other components destruction. This is a basic principle of ecosystem, so balancing in nature and put human being as part of ecosystem are some of indicators in measuring environmental paradigm.

II. LITERATURE REVIEW

Knowledge about ecosystem would be presumably lead to changes in human attitudes and finally direct his/her behavior, but it depends mostly on how human being view this world comprehensively. According to Bengen (2002), in order to utilize natural resources and its ecosystem rationally, it requires human efforts in conserving biodiversity and try to avoid its...
crisis and destruction by applying environmental regulations, laws, and policies which environmentally and sustainability sound.

Locus of control, according to Rotter (1978 in Schunk, Pintrich, and Meece, 2008:224), refers to social learning theory. Basically, locus of control describe about control location in individual personality related to its environment. Then, Rotter (in Schunk, Pintrich, and Meece, 2008:244) differentiate locus of control orientation into internal and external locus of control. An individual with internal locus of control tend to perceive that skill, ability, and effort are more as determinant factors related to what they have got in their life.

On the other hand, an individual with external locus of control tend to perceive that their life determined by the power from outside of them such as faith, luck or someone else which has the power. Therefore, it could be concluded that internal locus of control is much better than external locus of control, because as what predicted by Rotter (in Friedman & Schustack, 2002), external locus of control tend to be dependent and getting easier to become depression and stress and more defensive or passive when they face stressors.

Greenberg & Baron (2010, p.146) defined that “locus of control is the extent to which individuals that they are able to control things in a manner that affects them.” Moreover, Robbin & Judge (2013) stated that in organization, an individual with internal locus of control tend to (1) more taking part actively in running the organization; (2) has more clear in doing jobs; and (3) tend to choose decentralized organization.

On other occasion, McShane & Glinow (2015) stated that “locus of control refers to a generalized belief about the amount of control people have over their own lives” In organization, according to George & Jones (2012) describe that individual with internal locus of control is easier to be motivated than external locus of control. Individual with internal locus of control does not require a lot of direct due to their beliefs that work behavior affect good performances, well paid, compensation, reward and even promotion. Those explanation supported by Kinicki and Kreitner (2011, p. 133) which stated that “people who believe they control the events and consequences that affect their lives are said to possess an internal locus of control.”

More detail explanation proposed by Certo & Certo (2012 and also in Robbins, 2015) which stated that locus of control is someone beliefs about his/her behavior and when it is depended on events in side control of him/herself called internal control orientation or depended on events that occurred at outside of individual control called external control orientation.

However, for both LOC and students knowledge about ecosystem, there is no evidence that these two variables are related to gender equality. It has not been found yet whether male students is closely tend to be more internal LOC or reversely.

III. METHODOLOGY

This study is aim at obtaining information regarding students locus of control validation and its influence on knowledge about ecosystem based on gender. To achieve this objective, a survey method has been applied and 362 senior high school students from three big cities, Palembang, Jakarta, and Makassar, has been selected randomly as a sample.

There were two instruments used for this study, locus of control instrument consisted of 17 items and has been developed based on Rotter (1978) technique which each item concerns with two “forced-choice” by 2-1 scoring. A statement which related to internal locus of control (LOC) scored with 2, on the other hand, 1 score given to external LOC. Based on analysis, it was found that only item number 6 was not valid and LOC reliability found .705, after not valid item was omitted. In order to be easier in measuring both variables, table of specification below could be helpful to understand its content validity (Anastasi, 2002)

| Table 1. Students Knowledge about Ecosystem Blueprint (Odum, 2005) |
|---|---|---|---|
| Knowledge Dimensions | Concepts of Ecosystem | Interaction | Energy Flow | Nutrients Cycles and Limiting Factors |
| Knowledge about Facts | 1,2,3,4 | 5,6 | 7,8,9 |
| Knowledge about Principles | 10,11,12 | 13 | 14,15 |

<p>| Table 2. Locus of Control Blueprint |
|---|---|---|</p>
<table>
<thead>
<tr>
<th>No</th>
<th>Indicators</th>
<th>Items Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recognize your own fault</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>2</td>
<td>Effort in self development</td>
<td>4, 5, 6, 7</td>
</tr>
<tr>
<td>3</td>
<td>Feel self weaknesses</td>
<td>8, 9, 10, 11</td>
</tr>
<tr>
<td>4</td>
<td>Never blame someone else due to your fault</td>
<td>12, 13, 14</td>
</tr>
<tr>
<td>5</td>
<td>Self love belonging</td>
<td>15, 16, 17</td>
</tr>
</tbody>
</table>

Instrument measuring students knowledge about ecosystem consisted of 17 items as well and all items were valid, but its reliability was low (.402). However, both instrument could be implemented and data was analysed by descriptive statistics, K-R 21, and correlational analysis verified by t-test.

IV. RESULTS AND DISCUSSION

Based on descriptive statistics analysis, it is found that the average of LOC and student knowledge about ecosystem is high with low standard error (see table 3 below). It means that sample has high homogeneity.
Based on table 5 above, it is found that means difference between male and female LOC students is only below 1.00, i.e. .209 (equal variances) and for knowledge, means difference is .372 as well. These results are an indication that there is no significant means differences between male and female students, both for students LOC and knowledge about ecosystem (t-cal. only 1.071 for LOC and 1.419 for knowledge at .05 level). It could be interpreted that gender equality did not affect students LOC and knowledge about ecosystem. The same result was found also by Venus (2011) related to people New Environmental Paradigm (NEP) and gender.

As reported above that students LOC has a positive correlation with knowledge about ecosystem, but if correlation analysis conducted separately between male and female students, it is found that both correlation is positive and significant (see table 6 and 7 below). For male students LOC and knowledge about ecosystem (ECO), it is found that its correlation coefficient is .367 (p < .01). Compare to Male students, for female students, its correlation is .297 (p < .01).

<table>
<thead>
<tr>
<th>Table 3. Descriptive Statistics Analysis Results</th>
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<tr>
<td><strong>N</strong></td>
</tr>
<tr>
<td>Valid</td>
</tr>
<tr>
<td>Missing</td>
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<tr>
<td>Mean</td>
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<tr>
<td>Std. Error of Mean</td>
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<tr>
<td>Median</td>
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<td>Mode</td>
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<td>Std. Deviation</td>
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<td>Variance</td>
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<td>Skewness</td>
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<tr>
<td>Std. Error of Skewness</td>
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<tr>
<td>Kurtosis</td>
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<tr>
<td>Std. Error of Kurtosis</td>
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<tr>
<td>Range</td>
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<tr>
<td>Minimum</td>
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<tr>
<td>Maximum</td>
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<td>Sum</td>
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When those two variables be correlated, it is found that students LOC significantly has a positive correlation with students knowledge about ecosystem (.315, p < .01, see table 4 below). It could be interpreted that knowledge about ecosystem determined by students LOC (its contribution to knowledge around 63%), especially by students internal LOC, because the higher students LOC scores means that the higher their knowledge would be due to they have internal LOC orientation.

<table>
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<tr>
<th>Table 4. Correlations Matrix</th>
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<tr>
<td><strong>Pearson Correlation</strong></td>
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<tr>
<td><strong>LOC</strong> Pearson Correlation</td>
</tr>
<tr>
<td><strong>ECO</strong> Pearson Correlation</td>
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<td><strong>N</strong></td>
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**P < .01**

Table 5 below depicts a descriptive statistics analysis result when male and female students analyzed separately in order to verify whether gender equality affect students LOC and students knowledge about ecosystem as well.

<table>
<thead>
<tr>
<th>Table 5. Descriptive Statistics LOC and Eco Male vs Female Students</th>
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<td>**</td>
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<tr>
<td><strong>N</strong></td>
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<tr>
<td>Missing</td>
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<tr>
<td>Mean</td>
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<td>Std. Error of Mean</td>
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<td>Variance</td>
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<td>Std. Error of Skewness</td>
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<tr>
<td>Kurtosis</td>
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<tr>
<td>Std. Error of Kurtosis</td>
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<td>Range</td>
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<tr>
<td>Minimum</td>
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<td>Maximum</td>
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**P < .01**

Therefore, based on those results, it could be interpreted that gender equality affect the gratitude of correlation between male and female students related to LOC and Knowledge, but its correlation has similarity, the same significantly and positive direction. The only differences are on its contribution to students knowledge variances, male students contribute around 73.4 % (square of correlation .367) and female students only 59.4 % (square of .297). Nevertheless, male or female students LOC could be determinant factor on students knowledge about ecosystem empirically.
V. CONCLUSION

Some conclusions could be derived based on those research findings as follows.

1. Students LOC could be validated, then implemented scientifically based on Rotter (1978) instrument development, even though its reliability .705, means that around 49 % (square of .705) respondents felt that LOC instruments was reliable.

2. Students gender equality did affect LOC and knowledge correlation coefficients, therefore both male and female students, knowledge about ecosystem could be predicted by students LOC. They have similar linear correlation positive direction which means that if students knowledge about ecosystem would be improved, students LOC could be taken into consideration as well.

3. There is no evidence that there is means difference between male and female students, neither for LOC nor knowledge about ecosystem. In this case, it could not be stated that gender equality affect students LOC and knowledge. Since gender equality occurred at school setting, the role of education, in a specific term, the role of teaching and learning presumably could be taken into account. In a wider setting, it is better to more understand the position of each country dealing with its gender index where Indonesia (2012) is in rank 32 among 86 countries and the first rank occupied by Argentina with close to zero index means that there is no discrimination treated between men and women in this country.

VI. REFERENCES


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The Role of Job Resources on Work Engagement: A Study on Telecommunication Sector

Abdul Talib Bon and A. M. Shire

Abstract- The aim of this study was to examine the relationship between job resources, namely skill variety, task significance and task identity and work engagement. Data were gathered through questionnaire from a telecommunication organisation (N = 95). Results indicated that skill variety, task significance and task identity were a significant factor in influencing employees work engagement. These findings generally supported past findings, which suggested that employees are more likely to engage with their work if they are given useful job resources such as skill variety, task significance and task identity.

Index Terms- Job Resources, Skill Variety, Task Significance, Task Identity, Work Engagement and Telecommunication Companies.

I. INTRODUCTION

The characteristics of work environments can be classified in two general categories, which are job demands and job resources (Demerouti et al., 2001). These two job characteristics incorporate different specific demands and resources, depending on the context under study (Demerouti et al., 2001). According to the Job Demands-Resources model (Demerouti et al., 2001); job resources are defined as those physical, social, or organizational aspects of the job that (a) are functional in achieving work-related goals, (b) reduce job demands and the associated physiological and psychological costs, and (c) stimulate personal growth and development, while job demands are those physical, social, or organizational aspects of the job that require sustained physical and/or psychological effort and are, therefore, associated with physiological and/or psychological costs.

According to the J D-R model these two categories of work characteristics evoke two relatively independent psychological processes. First category is health impairment process and based on job demands. High job demands, which require sustained effort, may exhaust employees’ resources and lead to energy depletion and health problems (Jyoti & Rajib, 2016). For example, specific job demands (e.g., workload or emotional demands) have been repeatedly found to predict exhaustion (i.e., severe fatigue) among various occupational groups (Jyoti & Rajib, 2016, Bakker, Demerouti, & Euwema, 2005). The second category is motivational process and based on job resources. Job resources, due to their (intrinsic and extrinsic) motivational potential, foster employees to meet their goals. In turn, employees may become more engaged to their job, because they derive fulfillment from it (Hackman & Oldham, 1980).

Previous studies (Hakanen et al., 2006) have shown that several job resources (e.g., support or coaching) lead to work engagement, defined as “. . . the positive, fulfilling, and work-related state of mind that is characterized by vigor, dedication and absorption” (Alisha et al., 2016).

The aim of this study are to investigate the work engagement of employees in a telecommunication, as well as to investigate the relationship between job resources and work engagement. Therefore, this paper focuses the second category of work characteristics of the J D-R model, which is motivational process. The concept of work engagement is relevant for organisations for various reasons. Firstly, work engagement is related to job satisfaction, affective commitment and low turnover intention (Romina et al., 2016). Secondly, work engagement is related to personal initiative and learning (Hakanen et al., 2006). Research regarding the psychological foundations of work engagement will enable researchers and practitioners to understand and predict why some employees psychologically identify with their jobs.
II. LITERATURE REVIEW

A. Work Engagement

The concept of work engagement was first coined by Kahn in 1990, who defined it as "the harnessing of organizational members' selves to their work roles". It is the extent to which an individual is attentive and absorbed in the performance of his or her work. Kahn (1990) argued that when people are engaged, they are not only are physically involved in their work, but they also are cognitively alert and emotionally connected to others at the moment of engagement. However, the level of work engagement varies across individuals as the amount of energy and dedication they contribute to their job is different.

This concept has evolved through the years and has been regarded as a worthwhile concept by many researchers in studying burnout, health, job satisfaction, job performance and turnover intention of employees. Maslach et al., (2001) for example, have referred work engagement as the opposite of job burnout by defining burnout as an erosion of engagement. They argued that while burnout is defined by exhaustion, cynicism, and inefficacy, engagement is the direct opposite where energy replaces emotional exhaustion, involvement replaces cynicism, and a sense of efficacy replaces lack of professional accomplishment. Upasna, (2014) definition of work engagement was quite similar as what has been previously defined by Kahn (1990). They believed that work engagement consists of three components: physical – the energy used to perform a job, emotional – putting one’s heart in one’s job, and cognitive – being engrossed in a job. On the other hand, Carolyn & Paula, (2013) defined work engagement as a “positive, fulfilling, workrelated state of mind that is characterized by vigor, dedication and absorption.” They refer vigor as high levels of energy and mental resilience that related to work experience, and one’s eagerness to invest effort in work and to persist even when faced with problems. Individual will feel motivated, eager and excited about his or her work even when they faced with setbacks, limitations or challenges. Dedication is more of being deeply involved in one’s work and experiencing feelings of importance, passion, motivation and challenge. In other words, dedicated individuals would be happily involved in their work and felt that their work is important, meaningful and challenging. Finally, absorption is described as being content and having a total concentration on one’s work.

In the past, various predictors of work engagement have been studied and these include organizational commitment distributive, procedural justice, rewards and recognition; person-job fit and person-organization fit; leadership style (Maslach et al., 2001; Hamid & Yahya, 2011; Carolyn & Paula, 2013; Kahn 1990). However, work engagement has been mostly analyzed by the job demandsresources model. The model offers two assumptions regarding the predictors and outcomes of engagement at work. First, job resources such as peers and supervisors support, autonomy as well feedback, is assumed to commence a activational manner that guide to engagement at workplace, thus, lead to advanced performing. The following notion is that in a high demands situation (e.g. workload, emotional demands, and mental demands) job resources will become more prominent and gain their motivational potential (Bakker & Demerouti, 2007). This model has also been used to predict the influence of job characteristic, in terms of job demands and job resources on individual’s well-being (Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003). First is the process of exhaustion where job demands gradually reduce the mental and physical energy reserves that will finally lead to tiredness, burnout and other related health problems like a healthy grievance and functional disorder (authorized leave). Second is the activational manner where resources rise the preparedness to expend strength or to work hard. This at the end of the day will lead to engagement, to be committed and more activational consequences, as organizational citizenship behavior (OCB). Equally, collapse and enthusiasm manner have earned experimental support from numerous researches (e.g., Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003; Bakker, Demerouti, & Verbeke, 2004).

B. Job Resources and Work Engagement

Job resources are known to influence employee well-being intrinsically or extrinsically. As intrinsic motivators, job resources will satisfy the needs for autonomy, competence and individuals’ growth and development (Bakker & Demerouti, 2007). For example, supervisory coaching can improve job competence, while involvement in decision-making and colleague or supervisory support might fulfil the necessity for autonomy. Job resources might as well act as outer motivators. According to Schaufeli and Bakker (2004), and Bakker and Demerouti (2007) in a resourceful environments which includes supportive peers and performance feedback, the likelihood of being successful in completing one’s task and achieving one’s work goal may increase. It is expected that an appropriate supply of job resources might supplement employees’ work engagement while their deficiency can hinder goal accomplishment, and this may lead employees to develop a negative and cynical attitude towards their work.

Providing employees with optimal challenges, skill variety and task significance in their work creates intrinsic motivation and increases their work engagement (Ryan & Deci 2000). Task identity and positive feedback seems to enhance work engagement levels, whereas negative feedback diminishes it. Employees will be more engaged in their work if they regard their work as challenging and have the freedom to be independent in their work tasks. Roberts & Davenport (2002) found that career development, identification with the organisation and a rewarding work environment also increase the work engagement levels of employees. Employees will be
more engaged in their work if the organisation provides them with opportunities to enhance their skills and abilities, and to manage their careers. When individuals identify with the organisation, they share in its success and are proud to deliver quality work.

According to the self-determination theory of Deci & Ryan (1985), work contexts that support psychological autonomy, competence and relatedness enhance wellbeing and increase intrinsic motivation (Ryan & Frederick 1997). This intrinsic motivational potential is also supported by the Job Characteristics Theory (JCT) of Hackman & Oldham (1980). According to the JCT, every job has a specific motivational role that depends on the presence of five core job characteristics: skill variety, task identity, task significance, autonomy and feedback. The JCT further hypothesises that these core job characteristics are linked to positive results such as high-quality work performance, job satisfaction, and low absenteeism and turnover.

According to the Effort-Recovery Model of Meijman & Mulder (1998), job resources may also play an extrinsic motivational role through work environments that offer many resources and foster the willingness to dedicate one’s efforts and abilities to the work task. It is therefore likely that the work task will be completed successfully and that the work goal will be achieved. Support from colleagues and proper feedback from supervisors will thus increase the individual’s likelihood of achieving work goals, and employees will thus be successful in their daily tasks. This will create an energy backflow to the individual. In either case, whether the satisfaction of basic human needs or the achieving of work-related outcomes, the results are positive and the chances for an individual to be engaged will increase. The tendency for employees to leave the organisation will also decrease if organisations provide their employees with valued job resources that enhance learning, growth and development (Alisha et al., 2016). Schaufeli & Bakker (2004) found that work engagement is strongly predicted by job resources. It can therefore be expected that job resources have a positive relation to work engagement. If the employee is provided with variety in his/her job, learning opportunities and autonomy, he/she will be more likely to engage in his/her work. This will make the employee’s work more meaningful. Based on the discussions presented above, the following hypotheses are therefore proposed:

H1: Skill Variety (SV) is positively related to work engagement.
H2: Task Significance (TS) is positively related to work engagement.
H3: Task Identity (TI) is positively related to work engagement.

C. Research Theoretical Framework

A theoretical framework refers to the theory that a researcher chooses to guide him/her in his/her research. Thus, a theoretical framework is the application of a theory, or a set of concepts drawn from one and the same theory, to offer an explanation of an event, or shed some light on a particular phenomenon or research problem. Figure 1 presents research theoretical framework, which explains the relationship between job resources and work engagement.

![Figure 1: Research Framework](www.ijsrp.org)
III. METHODOLOGY

A. Research Design

Research design spells out how the research is carried out toward the accomplishment of research objectives and answering of questions. In other word, research design constitutes the outline for the collection, measurement and analysis data (Cooper and Schindler, 2013). Zikmund et al. (2012) defined research design as a master plan that outlines the methods and procedures for collecting and analyzing data. Moreover, research design helps the researcher in the allocation of inadequate resources by posing vital choices in methodology (Cooper and Schindler, 2013). The main research design employed in the present research was survey. Survey is defined as a measurement process that utilises a measurement tool called a questionnaire, measurement instrument, or interview schedule (Cooper and Schindler, 2013). Surveys attempt to describe what is happening or to study the reasons for an exacting business activity (Zikmund et al., 2012). The questionnaire is the most common information collection tool in business research (Cooper and Schindler, 2013). The questionnaire is the most extensively used information collection technique in a survey study (De Vaus, 2013). Questionnaire is an organized set of questions or measures used by respondents or interviewers to record answers data (Hair et al., 2010).

B. Sample Size

According to Cooper and Schindler (2013), sampling is the process whereby some elements from the population are selected to represent the whole population. Sample size is the number of units that is required to get accurate findings (Fink, 2003). For the purpose of this paper, the sample size was 95.

C. Data Collection

According to Sekaran (2003), there are many methods that can be possibly used to collect data from respondents such as interviews and questionnaires. Interviews involve unstructured and structured approach. Interviews can differ from being highly unstructured to highly structured. Unstructured interviews are usually conducted by an extremely flexible approach. A questionnaire, on the other hand, is a pre-written set of questions that respondents are required to answer, which is generally within close defined alternatives (Sekaran, 2003). A questionnaire is an efficient data collection mechanism but only when the researcher is aware of what is required and the measures of the variables involved (Sekaran, 2003). In the present paper, questionnaires were used because the researcher was interested in getting specific responses on the issues at hand i.e., job resources, and work engagement via specific measurements.

D. Measures

Two measuring instruments were used in this study, namely the Utrecht Work Engagement Scale (Schaufeli et al. 2002), the Job Resources Scale (Rothmann, Strydom & Mostert 2006) and a demographic questionnaire.

IV. FINDINGS

The descriptive and inferential statistical methods were used to conduct the analysis. For hypotheses testing, the Pearson correlation coefficients were used. The first part of the analysis focused on the descriptive analysis of the respondents. At the end of gathering data, the reliability of the scales was analyzed.

The descriptive analysis focused on the variables such as gender, age, marital status and job status as shown in Table I. Male responders represented 61% while female responders were 39%. Most of the respondents (45.9%) were aged between 35 and 39 years old, 8.2% of the respondents were between 25 and 29 years old, 10.8% of the respondents were between 30 and 34 years old, 18.9% of the respondents were above 50 years old and 16.2% of the respondents were between 40 and 49 years old. Majority of the respondents were having job permanent and were married in a percentage of 72% and 65.8% respectively. While employees; who have contract jobs represented 28% and single staff were 34.2% of the total respondents.
An exploratory and confirmatory factor analysis was performed in the study to ascertain the reliability of the measures by using Cronbach alpha reliability coefficient; .60 being the acceptable reliability coefficient level in terms of research standards as shown in Table II.

As it can be seen in Table I, the measures of the study are reliable because all the variables have an acceptable reliability coefficient which ranged from .845 to .925.

The correlation data shows the relationship between the independent and dependent variables of study as shown in Table III. The table displays correlation coefficients between these variables. The correlation coefficients are a measure of the strength of the association between any two metric variables (Hair et al., 2003). The results of the Pearson correlation show that all of the dimensions of the independent variables and dependent variable were positively correlated to each other. The results of Table III demonstrated that there is positive significant Pearson correlation between the three types of job resources work engagement (r=.556; p=.019). Hence the alternative hypothesis is accepted.

As it can be seen in Table I, the measures of the study are reliable because all the variables have an acceptable reliability coefficient which ranged from .845 to .925.

The aims of this study were to investigate the work engagement of employees, and its relationship with job resources. Work engagement was best predicted by job resources and the results of this study confirmed that job resources, namely skill variety, task
significance and task identity, are positively related to work engagement. The results of this study further showed that job resources were significantly related to the work engagement of participants. Therefore, the first hypothesis of the study is accepted as skill variety play a significant role in terms of the work engagement of the employees of Telecommunication Company. It seems that employees will be more engaged in their organization if the necessary job resources, such as skill variety, task significance and task identity, are provided, regardless of the level of job demands. Hakanen, Bakker & Demerouti (2005) showed that if job resources increases, it will have a positive effect on the work engagement levels of employees. Fifty-five per cent of the variance in work engagement of employees in this study was predicted by job resources opportunities. These results also support the hypothesis of this study, namely that job resources predict the work engagement of employees. Therefore, job resources appear to play a significant role in terms of the work engagement of employees. Growth opportunities in a job, such as variety, learning opportunities and autonomy, play an intrinsic motivational role by fostering the employees’ growth, learning and development. Task identity plays an extrinsic motivational role by being instrumental in achieving work goals (Schaufeli & Bakker 2004). An increase in job resources will increase the overall work engagement level of employees. A work environment that offers resources will foster the willingness of the employee to dedicate his or her efforts and abilities to the work task.

VI. CONCLUSIONS

The aim of the study was to analyse the relationship between job resources and work engagement. The adopted measures of this study have shown remarkable level of reliability as shown in Table I. Three hypotheses were developed; all of them were supported. Based on the findings of the study, the job resources have a significant relationship with work engagement. In addition the proposed hypothesis of types of job resources and work engagement was supported, which means there was a significant relationship between job resources and work engagement. Finally, job resources and work engagement have shown very significant relationship between them.

REFERENCES


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The Impact of Job Demands on Employees’ Turnover Intentions: A Study on Telecommunication Sector

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Abstract- High employee turnover intentions has always been a major issue for Telecommunication Sector. In particular, turnover intentions of employees in developing countries is very high. The aim of this paper was to examine the relationship between job demands and employees turnover intentions. Data were collected in four Telecommunication companies. A sample of 210 respondents (return rate: 87%) was available for statistical analyses. The findings generally supported past findings, which suggested that the turnover intentions of employees are high if the employees have high job demands.

Index Terms- Job Demands, Quantitative Demands, Attention Demands, Turnover Intentions and Telecommunication Companies.

I. INTRODUCTION

The topic of employee turnover intentions is a problem that organizations have dealt with for a long time. The first topics research regarding turnover focused on were “rates of departure” and “stability of employment”. These studies were conducted in the beginning of the twentieth century and employee turnover has been a widely researched topic ever since (Bakker et al., 2014). The interest in the topic has been increasing over the last decade or so, with over one hundred studies on the topic published in leading journals of management and related fields (Bakker et al., 2004). Turnover intention have been defined as the conscious and deliberate will of an employee to leave an organization, e.g. whether the employee has intentions to leave his job within a certain timeframe (Bothma & Roodt, 2012). There is evidence that employees form intentions to quit before actually deciding to resign, it is most often a process, and the employees most often make an informed and conscious decision to leave their job (Cropanzano & Mitchell, 2005).

Employee turnover is commonly defined as the combined number of employees that leave an organization in a certain time period and the turnover rate is the total number of employees that leave the organization to the total number of employees within the organization, often measured over one year (Bakker et al., 2014). There is a reason to make a distinction between whether the turnover is initiated by the organization or the employee. Involuntary turnover is initiated by the organization and often includes low performers and therefore the organization may generate better organizational performance after the dismissal. A high ratio of involuntary turnover can be an indication that the quality of the workforce is problematic (Kim & Stoner, 2008). Turnover that is initiated by the employee, i.e. voluntary turnover, can indicate a great loss of human capital that the organization would prefer to avoid, since these are employees that the organization most often would have liked to retain or at least not dismiss (Kim & Stoner, 2008). In the field of studies that has been conducted on turnover it has been considered more important to look at why people choose to leave the organizations voluntarily (Epitropaki, 2013). Ultimately the goal is not to eliminate turnover completely, since a certain flow of employees is important for an organization. There will always be some involuntary turnover from the layoffs the organization chooses to make, for example to get rid of low performing employees (Epitropaki, 2013).

Scholars have been directing much effort into investigating employees” turnover intentions towards their organisation (Kim & Stoner, 2008). Acknowledging the strategic importance of human capital, organisations adapt the strategic practices of human resource management to recruit, develop and retain this valuable asset. Retaining human capital is very important in the ever-increasing competition to employ the most valuable employees in the marketplace (Carmeli & Schaubroeck, 2015). Managers and researchers consider turnover a problem because of costs associated with it (Kim & Stoner, 2008). Turnover intentions refer to the subjective estimation of an individual regarding the probability that she or he will leave the organisation in the near future (Kim & Stoner, 2008). It is conceived to be a conscious and deliberate desire to leave the organisation within the near future, and considered as the last part of a sequence in the withdrawal cognition process (Mobley, 2013), which also includes thoughts of leaving and intentions to seek out alternatives (Tett & Meyer, 2011), in either a passive or an active job search (Kim & Stoner, 2008). Bakker et al., (2014) noted that turnover intentions are identified as the immediate precursor to turnover behaviour. Identification of the variables contributing to turnover intentions is considered to be effective in reducing actual turnover levels (Bakker et al., 2014).

The relationship between turnover intentions and actual turnover may vary across studies (Bakker et al., 2014). The relationship between turnover intentions and actual turnover may depend on the employee’s motivational basis and other opportunities for
employment (Kim & Stoner, 2008). Bakker et al., 2014 showed that there is consistent evidence that turnover intentions are the “strongest cognitive precursor of actual turnover”. Meta-analyses by Griffeth, et al., (2011) and Hom & Griffeth (2012) showed that intentions to quit are a major predictor of actual turnover. Cotton & Tuttle (2011) stated that three primary groups of variables have been identified as influencing turnover intentions. First come the organisational variables, such as job demands, occupational stress and gender discrimination; secondly are individual demographic variables, including gender, marital status and tenure; and lastly are the external variables, such as the availability of alternative employment. The relationship between turnover intentions and organisational variables is of particular importance, with considerable attention being applied to low job satisfaction and high psychological strain (George & Jones, 2012). These studies largely provide support for the two-step sequence model according to which stressful work affects turnover intentions via psychological strain (George & Jones, 2012). In this study, turnover intentions refers to three elements in the withdrawal cognition process: thoughts of quitting, the intention to search for another job elsewhere and the intention to quit (Mobley et al., 2013).

According to the Job Demands-Resources model can be predictors of employees turnover intentions (Demerouti et al., 2001). Job resources are defined as those physical, social, or organizational aspects of the job that (a) are functional in achieving work-related goals, (b) reduce job demands and the associated physiological and psychological costs, and (c) stimulate personal growth and development, while job demands are those physical, social, or organizational aspects of the job that require sustained physical and/or psychological effort and are, therefore, associated with physiological and/or psychological costs. According to the JD-R model these two categories of work characteristics evoke two relatively independent psychological processes. First category is health impairment process and based on job demands. High job demands, which require sustained effort, may exhaust employees’ resources and lead to energy depletion and health problems (Jyoti & Rajib, 2016). For example, specific job demands (e.g., quantitative demands, problem solving demands and attention demands) have been repeatedly found to predict turnover intentions among various occupational groups (Jyoti & Rajib, 2016).

Turnover intentions of highly skilled employees can be very expensive and disruptive for firms (Griffeth et al., 2011). Losing highly skilled staff members leads companies to incur substantial costs associated with recruiting and re-skilling, and hidden costs associated with difficulties completing projects and disruptions in team-based work environments (Griffeth et al., 2011). Determining the causes of turnover intentions within the Telecommunication workforce and controlling it through human resource practices and work system design is imperative for organizations.

II. LITERATURE REVIEW

A. JD-R Model

One of the basic assumptions of the JD-R model is that – independent of a particular work context - work environments can be characterized by two dimensions: job demands and job resources. Job demands are physical, psychological, social and organizational characteristics of a job, requiring physical and psychological effort and energy from an employee, which in turn are related to physiological and psychological costs (Bakker et al., 2007). Although job demands are not necessarily negative, they may turn into job stressors, when meeting those demands requires high effort (Bakker et al., 2007). Stress and burnout (i.e. emotional exhaustion) can result in lower quality and performance, and in increased absenteeism and turnover.

Job resources are physical, psychological, social and organizational characteristics of a job, which are instrumental in achieving work goals, reducing job demands, and the associated costs with them, and stimulate learning. Job resources are not only functional in achieving work goals; they also stimulate personal growth and development (Bakker et al., 2007). A second assumption of the JD-R model is that job demands and resources are related to well-being and attitudinal outcomes. The JD-R model postulates that the two sets of working conditions (i.e., demands and resources) may each evoke a different process. High job demands are likely to result in strain reactions (e.g., stress, burnout), which in turn may lead to an increase in absenteeism and turnover intention. The pathway from job demands to absenteeism and turnover via emotional exhaustion is also known as the energetic pathway. On the other hand, resources are likely to foster goal accomplishment, which in turn can lead to positive job attitudes (job satisfaction and organizational commitment) and reduced withdrawal behavior (reduced absenteeism and turnover). This pathway is also known as the motivational pathway (e.g., Bakker et al., 2007).

B. Quantitative Demands

Quantitative demand refers to work that requires hard work and fast, excessive work, time pressure and conflicting demands (Michelle, 2013). A concept associated with quantitative demand is workload (Moodie et al., 2014). Workload may refer to work time
commitments such as the number of hours devoted to paid work and work-related activities (Moodie et al., 2014), but it has also been referred to as time pressure, in which individuals perceive they have too many things to do and not enough time to do them (Luo et al., 2015). There are two main dimensions of quantitative demands at work named as intensity and extensity (Michelle, 2013). Intensity (work pace) is referred to as work pressure, and extensity is the number of working hours (Moodie et al., 2014). The quantitative demands could lead to quantitative overloads, which is defined as the amount of work that exceeds what an individual can accomplish in a given period of time (Moodie et al., 2014). One of the factors associated with the increase in the workload among employees is technology (Michelle, 2013). The proliferation of increasingly advanced gadgets such as mobile phones, pagers, fax machines and the internet have made it possible for employees to be in constant contact with their work and are thus unable to escape from work completely and relax. While at work, these same technological inventions have made it impossible for employees to concentrate on tasks as much as they would want to due to interruptions which are a major cause of stress (Michelle, 2013). Nikbin et al., (2012) found that jobs in the communication technology sector are characterized by a high degree of job demands, such as high workload and high time pressure. Employees working in communication technology sectors are under two main quantitative demands (intensity quantitative demands such as work pace and work fast, and extensity quantitative demands such as number of working hours) (Nikbin et al., 2012). For instance, telecommunication’s employees work under many types of quantitative demands such as lack of time to do their task, working longer hours per day or week, and faster work pace (Nikbin et al., 2012). Reducing workload is significant as Luo et al., (2015) have shown the negative effects of work overload on individuals, their family, and the organization they work in. To the individual employees, work overload is associated with burnout, negative emotions and feelings which may lead to mental disorders such as depression as well as drug abuse which lead to a myriad of physical health problems (Michelle, 2013). The family is also affected by work overload as far as the male or female parent is concerned; an effects that is not so pronounced in the lives of single people (Michelle, 2013). This affects their children if any besides their relations and is one of the reasons that have been given for the high divorce rates in recent decades (Michelle, 2013). The impact of work overload to the organization is the possible loss of employees as many of the employees that experience burnout have been found to eventually leave their jobs as well as less than optimum work that is characterized by errors and which is a point of loss for the organization’s resources (Moodie et al., 2014). Studies have also shown that workloads have negative relationship with employees’ job performance. For instance, Moodie et al., (2014) found that many employees experience burnout situations with work overload perform very low. Similarly, Michelle, (2013) found that high workload caused increasing cases of turnover intentions and low job performance.

C. Attention Demands

Attention demands concern the degree to which constant monitoring of work is required (Dieter & Elsy, 2016). Previous researches have helped to refine the job demands construct by proposing and clarifying possible sub-constructs. For instance, Dieter & Elsy, (2016) distinguished between monitoring demands, problem-solving demands, and production responsibilities. Dieter & Elsy, (2016) also included mental demands of work, such as attention demands and problem-solving demands. “The identification of these two demands is important because it helps clarify how work design can actually impact the information-processing requirements of work” (Michelle, 2013). Moodie et al., (2014) expanded on the distinction between psychological demands (e.g., precision requirements) and physical demands (e.g., muscular exertion), at least as these are experienced by manufacturing employees. Luo et al., (2015) discussed the distinction between workload demands, emotional demands, conflict between competing demands, and, possibly, role ambiguity demands, particularly applied to workers in human services organisations.

D. Hypotheses Development

The hypothetical model of the study is elaborated in the theoretical framework diagram which is shown in Figure 1. The Figure shows the hypothetical JD-R model of the relationships between job demands-resources, personal resources, affective organizational commitment, work engagement, turnover intentions and job performance of the employees of telecommunication technology sector.
Carmeli & Schaubroeck (2015) stated that three primary groups of variables have been identified as influencing turnover intentions. First come the organisational variables, such as job resources, job demands, occupational stress and gender discrimination; secondly are individual demographic variables, including gender, marital status and tenure; and lastly are the external variables, such as the availability of alternative employment. The relationship between turnover intentions and organisational variables is of particular importance, with considerable attention being applied to low job and personal resources and high job demands (Carmeli & Weisberg, 2012). Therefore, the following hypothesis is offered to be tested:

H1: Quantitative demands will be positively related to turnover intentions.

H2: Attention demands will be positively related to turnover intentions.

III. METHODOLOGY

A. Participants and procedure

The study sample consisted of Telecommunication employees from four different companies, who held a variety of jobs, which helped increase the potential generalizability of the findings. Overall, 210 surveys were distributed, accompanied by a letter that emphasized and assured the anonymity and confidentiality of the data. The employees were asked to return their completed questionnaires in pre-stamped envelopes. The response rate for the questionnaire was relatively high: 87% percent (N=183). Of the 123 employees, 73 percent were male, with an average age of 39 years old. The majority of the participants worked full time, and organizational tenure was 8 years. About 62 percent of the participants held a university degree.

B. Measures

For all constructs a five-point scale was used to measure respondents’ levels of agreement with each statement (1= strongly disagree, 5= strongly agree). This was done to keep the questionnaire simple so that employees with low or high educational levels would be able to respond to the items, and a comparison of the mean scores of the different dimensions would be possible. Two measuring instruments were used in this study, namely the turnover intentions Scale (Mobley et al., 1978), the Job Demands Scale (Rothmann, Strydom & Mostert, 2006) and a demographic questionnaire.

C. Statistical Analysis

Structural Equation Modelling (SEM) is an advance statistical analysis method used to understand and analyze complex relationships between constructs in various disciplines, including social sciences. Furthermore, it has been used to evaluate more complex and
sophisticated multivariate data, while multivariate analysis facilitates statistical investigation that simultaneously analyze multiple variables (Hair et al., 2014). SmartPLS (version 3.0.M3) is suitable software and chosen to analyze and test this research data.

IV. FINDINGS

The results show that there was significant relationship between the job demands and the employees’ turnover intentions. Reliability refers to the “extent to which a variable or set of variables are consistent in what it is intended to measure” (Hair et al., 2014). In other words, reliability refers to the degree the latent variable reflects its true value with free errors. To further investigate the reliability of the proposed constructs, Cronbach’s Alpha and composite reliability measures were analysed and can be extracted from (PLS-SEM). The measurements with Cronbach’s Alpha and composite reliability above 0.70 are considered reliable and acceptable (Hair et al., 2014). Compared to Cronbach’s Alpha, Composite reliability is regarded as a more rigorous assessment of reliability (Hair et al., 2014). The reliability level of the proposed constructs in this paper are documented in Table I. The results show that both Composite Reliability and Cronbach’s Alpha values are above 0.90, consequently, the model realized an acceptable level of reliability.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach's Alpha</th>
<th>Composite Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD</td>
<td>0.953</td>
<td>0.959</td>
</tr>
<tr>
<td>QD</td>
<td>0.979</td>
<td>0.994</td>
</tr>
<tr>
<td>TOI</td>
<td>0.974</td>
<td>0.996</td>
</tr>
</tbody>
</table>

Similarly, the structural model is an important instrument for assessing the significance level of the path coefficients between the variables. The analysis of the path coefficients was shown in Figure 2. The model presents the relationship between two variables of job demands and the employees’ turnover intentions; the results display a positive significant path coefficient of 0.171 and 0.235 for quantitative demands and attention demands with employees’ turnover over intentions respectively and with an R² value of .097. Moreover, this model shows that only outer weight of item 1 (QD1) of quantitative demand is small .412 but significant, while on the other items of the variables are strong and significant. Also, the assessment of structural model using (PLS-SEM) requires the execution of bootstrapping, hence, the results including the T test are documented in Table II. The T statistics indicated that both the path coefficients of quantitative and attentions demands with turnover intentions are significant of 2.520 and 3.378 respectively.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variable</th>
<th>Path Coefficient</th>
<th>T statistics</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover Intentions (TOI)</td>
<td>Quantitative Demands (QD)</td>
<td>0.171</td>
<td>2.520</td>
<td>0.097</td>
</tr>
<tr>
<td></td>
<td>Attention Demands (AD)</td>
<td>0.235</td>
<td>3.378</td>
<td></td>
</tr>
</tbody>
</table>
V. DISCUSSION

Turnover has been a problem for organizations since the 1960s. Since then, several studies have been conducted to shed light on the problem. In this study, it was adapted the Job-Demands-Resources (JD-R) Model to examine the general relationships between particularly two job demands such as quantitative and attention demands and turnover intention. Both $H1$ and $H2$ predicted a positive association between quantitative and attention demands with Turnover intentions. Consistent with theses hypotheses, the three latent variables were positively and significantly associated. The direct effect of the demands on Turnover intentions was highly significant.

It was tested the basic assumptions of the model in a sample of Telecommunication Technology workers. In general, the results support the assumptions of the JD-R model.

In line with calls for empirical studies in the fields of HRM and talent management to pay specific attention to high potential employees, this study examines the antecedents of Turnover intentions among the group. Applying the social exchange perspective, we investigated whether the job demands variables results in increased levels of Turnover intentions. The model was tested on a data set comprising 183 high potential employees from 4 Telecommunication companies. Our findings suggest that the greater the extent to which high potential employees experience high job demands, the more they are disengaged from work at their companies and expose high level of turnover intentions. This is in line with the social exchange perspective, according to which inducements such as negative and unbeneficial actions directed at employees by the organization create conditions for employees to reciprocate in negative ways. Based on this notion, we can confirm that when Telecommunication companies induces high level of job demands activities at high potential employees, they tend to return this organizational investment in the form of increased Turnover intentions. This finding is also in line with the positive relationships revealed in a meta-analysis of the association between high job demands and employee attitudes (Shaw et al., 2009).

Our results also indicate that the association between job demands and employee attitudes such as Turnover intentions is more complex than typically assumed. In line with the social exchange perspective, our findings demonstrate that it is through the fulfilment of psychological contract that high potential employees become more disengaged with their Telecommunication in response to high job demands activities. This finding leads to the conclusion that high job demands shape the employees’ interpretations of the terms of their psychological contract, and signal the kinds of attitude such as high turnover intentions that are appropriate to the input of the organization.
VI. CONCLUSIONS

The aim of the study was to analyse the relationship between job demands such as quantitative and attention demands with turnover intentions. The adopted measures of this study have shown remarkable level of reliability as shown in Table I. Two hypotheses were developed; both of them were supported. Based on the findings of the study, the job demands variables such as quantitative demands have a significant relationship with turnover intentions. In addition the proposed second hypothesis of attention demands and turnover intentions is also supported, which means there was a significant relationship between job demands and turnover intentions.

REFERENCES


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Abstract- Palm fruit is an edible oil crop which needs to be processed for oil extraction. However, the manual method of stripping and the existing palm stripper are found ineffective due to prolonged stripping time leading to low quality and quantity of oil produced. Modern methods of stripping have greatly improved production rates and reduced stripping time. The main objective of this Work was to come up with an improved design and fabricate a palm stripping machine with locally available material that is low-cost, higher through put, better efficient, easy to operate, easy to maintain and affordable to both small and medium scale palm oil processors. Work was also done to ascertain the physical characterization of the palm fruit bunch seed and the force required to detach them before sterilization and after using steam was obtained. From the design and experimentation carried out, we found out that the most efficient is the horizontal concept. Here, the beater strikes the palm bunch fruit, throwing it upward to drop on its weight on the beater severally. The dried strip or empty bunches were discovered to be useful fuels for boilers that generate the needed steam for sterilization. Proper bearing selection based on bearing calculation in Solid-Works was done and this in-turn was seen to have improved the installed pillow bearings along with cost savings in maintenance by following a simple lubrication and corrosion control procedures. The results indicated that stripping efficiency of the machine and the clean fruit recovery were 98.91 % and 96.03 %, respectively. The feed rate of the stripper ranges between 341.4 kg/h and 360.02 kg/h, the output capacity ranges between 227.47 kg/h and 275.78 kg/h while the operating capacity is 70.54 g/s. Therefore, the palm fruit stripper is recommended for the small and medium scale palm oil processing industries.

Index Terms- Design and Fabrication, palm fruit stripper, performance evaluation, output capacity

I. INTRODUCTION

The oil palm (Elaeis guineensis) plays an important role in the agricultural and economic sectors of those countries where it is found. It originated in the tropical rain forest region of West Africa. The main belt runs through the southern latitude of Cameroon, Cote d’Ivoire, Ghana, Liberia, Nigeria, Sierra Leone and Togo into the equatorial regions of the Republic of Congo and Zaire (Hartley, 1988). However, because of its economic importance as a high yielding source of edible and technical oils, the oil palm is now grown as a plantation crop in most countries with high rainfall (minimum 1600mm/year) in tropical climates within 10° of the equator (FAO, 2004). Samuel and Alabi (2012) reported that productivity in Nigeria was poor and such important vegetable oils should be highly produced to meet demands. The total money of $186.65 million was spent by Nigeria to import vegetable oil from Malaysia in 2001, this showed sad state affair of the country (Samuel and Alabi, 2012).

The palm bears its fruits in bunches varying in weight from 10 to 40kg. The individual fruit ranges from 6 to 20 grammes and are made up of an outer skin (exocarp), a pulp (mesocarp) that contains the palm oil in a shell (endocarp) and the kernel which itself contains palm kernel oil (Stork, 1960). The palm oil and palm kernel oil have a wide range of applications; about 80 % of the palm oil produced finds its way into food products while the rest is feed stock for a number of non-food applications. The by-products of oil palm fruit processing such as empty bunches and fibres can further be processed as raw materials for potash fertilizer, pulp and paper manufacturing (Ologunagba et al., 2009; Salamiah, 2000). The kernels contain 80 % oil and 9 % protein (FAO, 2009) and are processed for oil and cake. The oil is used for the producing edible oil, margarine, confectionary, soap, candle glycerin and ice cream. The cake is used for formulation of animal feeds. The shell fragments can be used as renewable energy (fuels) and for decoration of living apartments (FAO, 2009; Mahmud et al., 2009; Antia et al., 2014).

The palm fruits are obvoid in shape and are of three varieties, the dura types have thick mesocarp with a thin mesocarp, the pisifera types are shell-less variety while the hybrid, tenera types have a much thicker mesocarp, and a thinner endocarp (The Tropical Agriculturist, 1998).

As fruits ripen, they change from black (or green) to orange, but have varying degrees of black cheek colour depending on light exposure and cultivar. The fruit bunches are harvested using chisels or hooked knives attached to long poles. Processing of oil palm fruits bunches into palm oil is practiced using various methods which may be grouped into four categories according to their throughput and degree of complexity of the unit operational machinery.

Stripping or threshing of palm fruit involves separating the sterilized fruits from the bunch stalks. Sterilized fresh fruit bunches are fed into a drum stripper and the drum is rotated, causing the fruits to be detached from the bunch; the bunch stalks are removed as they do not contain any oil (FAO, 2004).

In Nigeria today, a lot of work has been done on palm fruit stripping and most of the mechanized systems of stripping oil from palm fruit bunches consist of a rotating drum or fixed drum equipped with rotary beater bars detach the fruit from the bunch, leaving the spikelet on the stem. These strippers are available in NIFOR, Benin and Nigeria (FAO, 2004). Ologunagba et al. (2009) reported that when manually operated a dual powered
palm fruit stripper, the machine had a throughput capacity of 0.612 tons/h, stripping efficiency of 68.9% and quality performance efficiency of 47.4% at a sterilization time of 90 minutes. When tested with 2.25KW electric motor at three beater speeds (250, 350 and 450 rpm) and at sterilization time of 30, 60 and 90 minutes, the machine gave best performance at 450 rpm and sterilization 90 minutes.

Traditionally, the harvested palm fruit bunches is heaped and allowed to ferment to facilitate easy stripping of the fruits. The picked fruits are then collected and digested into a mash, after which it is mixed with water and agitated in a pit to separate the crude oil from the mixture. After adequate mixing, the oil that floats at the tip is scooped off for clarification. Apart from the drudgery, time wasting and high labour requirement in this method, it gives poor quality oil as the period of fermentation increases the free fatty acid (FFA) content of the oil. According to Badmus (1991), processing the fruit without delay or fermentation yielded the highest oil extraction of 87 percent and best quality oil with free fatty acid (FFA) of 2.31 percent. Hence, it is important that fresh fruit bunches be processed as soon as possible so as to prevent a rapid rise in free fatty acid which normally affect the quality of crude palm oil.

Though the technology of palm oil production has advanced in recent years with new technological innovation to produce palm oil and palm kernel oil of superior quality (Stock, 1961), survey results showed that 80 percent of Nigerians oil palm resource exist in small holder plantations and wild groove (Badmus, 2002), and thus the nation’s oil palm industry is still subsistent with very few large estate plantations that make large mills and imported mills relatively expensive and unaffordable by most farmers, thereby making the traditional method to predominate.

Therefore, this research work is aimed at solving the associated problems and difficulties facing the farmers in the business of palm oil processing in Nigeria by designing and fabricating a machine with locally available material that is low-cost, higher throughput, better efficient, easy to operate, easy to maintain and affordable to both small and medium scale palm oil processors.

II. MATERIALS AND METHOD

2.1 Machine Description and Operation

The palm fruit stripper consists of four basic units viz: The feeding unit, the stripping unit, the drive mechanism and the discharge outlets. The quartered palm fruit bunches is fed through the hopper into the stripping unit. The hopper is made from 16-gauge sheet metal formed into a trapezoidal shape designed to handle a targeted machine capacity of 2.0 tons fruit bunch per hour. It has a vertical height of 330mm with sides inclined at 50° to the frame work to help slide the quartered bunches into the stripping unit.

The stripping unit is where the fruits are being detached from the quartered bunches. The unit consists of a shaft made up of 25mm mild steel rod, a housing made from 16-gauge sheet metal rigidly mounted on the frame to withstand the load it has to bear, and mild steel rods of 10mm diameter laid horizontally and inclined at 60° in spacing of 50mm to the housing to ensure throwing up of the bunches without becoming jammed half-way. The shaft is 1200mm long and attached with beaters, each of 12mm diameter and 100mm long helically spaced at 50mm to produce the necessary impact that detach the fruits as well as convey the stripped bunches from the point of entry to the point of discharge. The machine is powered electrically with the aid of belt and pulley arrangement which has 230mm diameter driven pulley and 75mm diameter driver pulley connected to a single phase 2.25kw(3HP) electric motor. As the shaft rotates, the impact of the beaters on the bunches detach the fruits which are collected at the fruit discharge outlet located beneath the stripping unit while the stripped bunches are conveyed to be discharged at the stripped bunch discharge outlet. Figure 1 shows the isometric view of the electrically powered palm fruit stripper.

<table>
<thead>
<tr>
<th>#</th>
<th>Legend</th>
<th>#</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Housing</td>
<td>5</td>
<td>Electric motor</td>
</tr>
<tr>
<td>2</td>
<td>Beaterarm</td>
<td>6</td>
<td>Bolt and nut</td>
</tr>
<tr>
<td>3</td>
<td>Frame</td>
<td>7</td>
<td>Fruit outlet</td>
</tr>
<tr>
<td>4</td>
<td>Pulley</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: isometric view of the Horizontal Stripping Machine
2.2 Design Considerations

Some of the factors which were taken into account while designing the palm fruit stripper are as described:

Reliability and performance of the various components

Factors such as rigidity, deflection, wear, corrosion, vibration and stability were considered in the selection of appropriate material, sizing and shaping of the various machine components. Also, in order to take into account a number of uncertainties such as variation in material properties, effect of environment in which the machine is expected to operate, and the overall concern for human safety, provisions were made through the use of factor of safety stipulated by standard and experience.

Availability of materials

The machine was constructed of locally available materials so as to enhance the possibility of replacing damaged parts with less expensive but equivalently satisfactory parts that are locally available.

Simplicity

The ease of design and fabrication of machine for productivity were considered, bearing in mind the need of dismantling to carry out routine cleaning and maintenance of the machine when necessary so as to maintain higher level of performance. And also for the possibility of conveying the machine from one point of use to the other whenever the need arises.

Effectiveness

Meeting the farmers general requirements with minimum loss of oil that may arise from oil being absorbed and carried off by the stalks of the stripped bunches or loss due to unstripped fruits still attached to the bunches. And also the need to have a fruit discharge outlet that is different from the stripped bunch discharge outlet for optimum separation.

Cost

The reduction of cost was taken into account through critical value analysis on the phases of design, material selection, production and maintenance of the machine which at the end make it affordable by farmers and other intending users.

2.3 Design Analysis

In the design of this machine, relevant physical and mechanical properties of oil palm fruits were considered as a basic design input for the determination of the mesh size for the drum sieves and power requirement. Other factors considered include availability of materials, cost of materials, durability, and the ease of feeding and discharging of palm fruit bunches, and the condition of palm fruit bunches before stripping.

- Stripping Chamber:

The stripping chamber is cylindrical in shape with diameter of 0.580m, the circumference of the circular section of the cylinder is given in equation as suggested Balogun et al (2009).

\[ C_c = \pi D \]

\[ D = \text{diameter of the cylinder} = 0.58m \]

- Volume of the stripping unit (cv):

The mathematical expression given by Bologun et al (2009) was adopted to determine the volume of the stripping unit.

\[ CV = \pi r^2 h \]

Where \( h = \text{height of the stripping unit} \) (m)

\[ r = \text{radius of the stripping unit} \] (m)

- Gear Speed of the Stripper

Gear speed of the stripper was determined by equation 3 as recommended by Khurmi and Gupta, (2005)

\[ \frac{T_g}{T_P} = \frac{N_g}{N_p} \]

Where

- \( T_g = \text{Number of teeth of the Gear} \)
- \( T_P = \text{Number of teeth of the pinion} \)
- \( N_g = \text{Speed of the Gear} \)
- \( N_p = \text{Speed of the pinion} \)

- Shaft Diameter:

Shaft diameter was obtained from the following expression given by Khurmi and Gupta (2005)

\[ d^3 = \frac{16\sqrt{(K_b M_b)^2 + 2} \sqrt{(K_t M_t)^2}}{SS} \]

Where

- \( d = \text{shaft diameter (mm)} \)
- \( K_b = \text{combined shock and fatigue factor for the Bending moment} = 1.5 \)
- \( M_b = \text{maximum bending moment (Nm)} \)
- \( M_t = \text{Maximum Torsional Moment (Nm)} \)
- \( S_s = \text{Allowable shear stress of mild steel} = 450\text{mm}^2 \)

- Selection of Pulley Speed

The Type of pulley selected was determined using by equation as stated by Onifade (2016) Stephen and Emmanuel (2009).

\[ \frac{N_1 D_1}{N_2 D_2} = \frac{N_1}{N_2} \]

Where

- \( N_1 = \text{speed of the driving pulley (rpm)} \)
- \( D_1 = \text{diameter of driving pulley (mm)} \)
- \( N_2 = \text{speed of the driven pulley (rpm)} \)
- \( D_2 = \text{diameter of the driven pulley (mm)} \)

- Belt length and Centre Distance

The center distance between the two adjacent pulleys and belt length were calculated using equation as determined by Khurmi and Gupta (2005), Akande and Onifade (2015)

\[ C = \frac{D_2 + D_1}{2} + D_1 \]

For belt length

\[ L = \frac{\pi}{2} (D_2 + D_2) + 2C + (D_2-D_2)^2 / 4C \]

Where:

- \( C = \text{center distance} \)
- \( T_1/T_2 = e \phi \)

Where \( T_a = \text{Tension in the tight side of the belt, N} \)

\[ T_2 = \text{Tension in the slack side of the belt N} \]

\[ \phi = \text{angle of warp in red} \]
\[ \mu = \text{co-efficient of friction between belt and pulley} \]

**Power Requirement**

A change in speed of any fan in operation will predictably change the pressure rise and power necessary to operate under a predictable set of laws concerning its speed, power and pressure (Ojomp, et al, 2010). The law can be applied to Agricultural equipment that uses shaft as a power take off, one of the equations from these laws is given as

\[
\frac{Kw1}{Kw2} = \left( \frac{N1}{N2} \right)^2
\]

Where
- \( Kw1 = \text{power from the motor kw} \)
- \( Kw2 = \text{power required by the Gear shaft, kw} \)
- \( N1 = \text{speed of the gear shaft rpm} \)
- \( N2 = \text{speed of the motor rpm} \)

**2.4 Performance Evaluation**

The machine was installed on a level and hard surface. Sixty kilogram freshly harvested palm fruit was purchase from a nearby farm and 5kg of oil palm fruit bunch was prepared for the machine test. Each experiment was carried out in four replicates. The stripper was evaluated using the various formular

- **Determination of feed rate**

\[
Fr = \frac{QBF}{TF}
\]

- **Determination of the output capacity**

\[
\text{output capacity} = \frac{\text{Weight of palm fruit Stripped} + \text{Weight of empty bunch}}{\text{Time of stripping}} \times \frac{WFs + Wf}{Ts}
\]

\[
Qe = \frac{WFs + Wf}{Ts} \times 100%
\]

- **Determination of machine efficiency**

\[
M_E = \frac{WFs}{WFT} \times 100%
\]

- **Determination of quality performance efficiency**

\[
\text{Quality Performance efficiency} = \frac{\text{Weight of empty bunch} + \text{Weight of fruit unstripped}}{\text{Weight of Stripped fruit}}
\]

III. RESULT AND DISCUSSION

The benefits of the improved stripper are based on the result of the test obtained

<p>| Table 1: Performance Test Conducted on the Bunch Stripping Machine |
|------------------------|-------|-----|-------|-------|-------|-------|</p>
<table>
<thead>
<tr>
<th>S/N</th>
<th>( WAB ) (kg)</th>
<th>( N_{SF} )</th>
<th>( N_{UF} )</th>
<th>( W_{FB} ) (kg)</th>
<th>( W_{EB} ) (kg)</th>
<th>( W_{WFB} ) (kg)</th>
<th>( T ) (Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8.8</td>
<td>956</td>
<td>6</td>
<td>962</td>
<td>6.5</td>
<td>2.80</td>
<td>6.55</td>
</tr>
<tr>
<td>B</td>
<td>8.4</td>
<td>918</td>
<td>4</td>
<td>922</td>
<td>5.7</td>
<td>2.50</td>
<td>584</td>
</tr>
<tr>
<td>C</td>
<td>15.4</td>
<td>1150</td>
<td>15</td>
<td>1165</td>
<td>10.1</td>
<td>5.10</td>
<td>10.25</td>
</tr>
<tr>
<td>D</td>
<td>45</td>
<td>345</td>
<td>5</td>
<td>350</td>
<td>3.6</td>
<td>0.98</td>
<td>3.96</td>
</tr>
<tr>
<td>E</td>
<td>55</td>
<td>355</td>
<td>5</td>
<td>360</td>
<td>446</td>
<td>0.99</td>
<td>4.86</td>
</tr>
<tr>
<td>F</td>
<td>9.8</td>
<td>980</td>
<td>15</td>
<td>993</td>
<td>6.99</td>
<td>3.2</td>
<td>6.49</td>
</tr>
<tr>
<td>AV</td>
<td>8.7</td>
<td>784</td>
<td>8.3</td>
<td>793</td>
<td>6.99</td>
<td>2.595</td>
<td>6.325</td>
</tr>
</tbody>
</table>

AV = Average values
\( WAB = \text{Total weight of bunch, kg} \)
\( N_{SF} = \text{number of fruitlets stripped} \)
\( N_{UF} = \text{number of fruitlets unstripped} \)
\( N_{TF} = \text{total number of fruitlets} \)
\( W_{FB} = \text{weight of fruitlets removed from each bunch kg} \)
\( W_{EB} = \text{weight of empty bunch kg} \)
\( W_{WFB} = \text{weight of the whole fruit in each bunch, kg} \)
\( T = \text{stripping line, sec} \)

<p>| Table 2: Result obtained on the output parameters |
|------------------------|-------|-----|--------|----------|--------|----------|</p>
<table>
<thead>
<tr>
<th>S/N</th>
<th>Total of Weight of Bunches kg</th>
<th>Time taken sec</th>
<th>strip ability kg/h</th>
<th>Input capacity kg/h</th>
<th>Output capacity kg/h</th>
<th>Clean fruit recovery %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8.8</td>
<td>90</td>
<td>99.30</td>
<td>352.00</td>
<td>265.00</td>
<td>99.23</td>
</tr>
<tr>
<td>B</td>
<td>8.4</td>
<td>85</td>
<td>99.56</td>
<td>355.98</td>
<td>241.52</td>
<td>97.60</td>
</tr>
<tr>
<td>C</td>
<td>15.4</td>
<td>160</td>
<td>98.71</td>
<td>346.84</td>
<td>227.47</td>
<td>98.52</td>
</tr>
<tr>
<td>D</td>
<td>45</td>
<td>47</td>
<td>98.60</td>
<td>344.82</td>
<td>275.78</td>
<td>91.13</td>
</tr>
<tr>
<td>E</td>
<td>5.5</td>
<td>58</td>
<td>98.61</td>
<td>341.40</td>
<td>273.74</td>
<td>91.76</td>
</tr>
<tr>
<td>F</td>
<td>9.8</td>
<td>98</td>
<td>98.69</td>
<td>360.02</td>
<td>256.79</td>
<td>97.99</td>
</tr>
</tbody>
</table>

IV. CONCLUSION

A palm fruit stripper that can be electric motor operated was designed and constructed with locally available materials. Based on the performance test results, the throughput capacity, stripping and quality performance efficiencies increase with sterilization time and beater shaft speed. Using the electric motor for operating the palm fruit stripper, it gave the best work performance at 450rpm with throughput capacity of 2.14 tons/hr, stripping efficiency of 96.1% and quality performance efficiency of 81.9%. Therefore, this simple machine can help solve the
associated problems and difficulties of palm fruit bunch stripping, especially for small and medium-scale farmers

V. RECOMMENDATION

In large industries processing palm fruit into edible oil, the mechanized stripping machine is recommended for production of palm oil to meet up the growing demand of palm oil in the world market because of its relevance in production of other useful products. More so, the subject of design and manufacturing technology in the tertiary institutions should be greatly encouraged and should be well taught so that competent and innovative graduate are produced into the dynamics world of technology.

REFERENCES


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The Influence of Financial Risk on Stock Returns

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Abstract- The decline in stock returns and the increasing financial risks at the stock market in Kenya has solicited discussions at the academic and regulatory circles to find solutions on challenges facing investor’s capacity to reliably predict stock returns volatilities. This study sought to investigate the influence of financial risk on stock returns. Annual data for period 2006 to 2015 has been used. The stock return data of 9 banks listed from 2006 to 2015 was used as dependent variable while credit risk, market risk, liquidity risk and capital risk was used as independent variables. Bank size was used as a control and moderator variable. The study adopted a multivariate generalized least square regression modeling. The study focused on two dimension regression approach. Individual impact of financial risk on stock return and collective multivariate impact of financial risk on stock returns. Individual regression of credit risk, market risk, liquidity risk and capital risk show a statistical significant positive relationship with stock returns. Collective multiple GLS regression of financial risk with a control variable of bank size indicated financial risk is negatively significant on stock returns while bank size had a positive significant influence on stock returns. Moderating effect of bank size on the influence of financial risk on stock returns was found positively significant. The overall conclusion of study was held that financial risk influences stock returns of at Nairobi Securities Exchange. This research is a spatial extension of the previous researches. Unlike other studies that focus mainly on macro-economic variables, this research factored the influence of systemic and bank specific factors financial risk on stock returns.

Index Terms- Financial risk, Stock returns, Credit risk, market risk, Liquidity risk, Capital risk, Bank size.

I. INTRODUCTION

Investors exist at the stock market to maximize their returns. Banks leverage this objective through their core function of financial intermediation. However, the main economic function of banks revolves taking financial risk. If banks avoid risk in order to minimize failure rates to zero, they limit the purpose of banking system to promote investor market value (Greuning&Bratanovic, 2009). The aftermath of global financial crisis has exhibited unprecedented stock returns volatilities leading to huge lose and uncertainties on portfolio investments for local and international investors. This phenomenon of increased financial risks at the capital and financial markets has solicited discussions at the academic and regulatory circles in a bid to find solutions on challenges facing investor’s capacity to reliably predict the highs and the lows of the stock returns (Sobia, Arshad&Szabo, 2015). Empirical literature remains nascent and contradictory on the actual determinants of stock returns sensitivity. However, Bhatiand Sultan (2012), Mehri (2015) argued that financial risk theoretically and empirically is proven to influence stock returns. Sobia,et al. (2015) established that investors in emerging markets are mere herd and noise traders as they fail to consider external and internal fundamentals in their investment decisions. To maximize wealth, investors require accurate and reliable information on the drivers of stock prices. Maxims of efficient market hypothesis contends that stock prices responds to news released to the markets which could be in the form of financial statements, press briefings or insider information. Massive loss of investor’s wealth in the stock markets and world economic turmoil during the global financial crisis has been associated to financial risk (Mehri, 2015). In this regards, this study sought to establish the influence of financial risk on stock returns at Nairobi Securities Exchange. Stock return is the measure of shareholder wealth in the security exchange where investors seek to maximize wealth by undertaking financial risk. Stock market is a market that facilitates trade of securities from publicly quoted companies and government securities. A stock market form is an important entity to the government, investors and other stakeholders. It’s a backbone of an economy since it promotes efficient capital allocation and wealth creation. Studies show stock markets are significant for economic growth (Sobia et al. 2015). Jorion (2007 referred financial risk as the uncertainty and potential financial loss to earnings and capital. Haque and Wani (2015) defined financial risk as an umbrella term of risks factors resulting to financial losses triggered by financial transactions. These umbrellas of risk factors for banking sector majority include credit risk, market risk, liquidity risk and capital risk. Financial risk can be broadly classified into diversifiable risk based on company specific risk factors and un-diversifiable risk due to macroeconomic factors. The importance of commercial banks to an economy is to link surplus and deficit units. However, as banks intermediate, they face a series of financial risks which are detrimental to sustainability of a financial system. To balance the extent of risk is crucial for survival of banks, economy and investor wealth. However, no investor will maximize their returns without engaging in risk. The impact of financial risk has been observed to by cyclical where systemic risk triggers emergence of other financial risks. Market risk triggers liquidity risk and credit risk. Credit risk and liquidity risk collectively triggers capital risk (Cheng &Nasir, 2010). Haque and Wani (2015) observed that financial risk exists in an eco-system of systemic risks where external financial risk triggers internal risk during economic recession and internal financial risk triggers external risk during boom. Stock return volatility refers to the uncertainty of returns of the underlying assets due to changes in flow of information.
concerning the stock into the stock markets. Negative information increases the variability over varied periods making it difficult for investors to predict stock returns. Stock volatility is characterized by the ups and downs of the stock markets inferred by bull and bear episodes where the stocks increase from trough to peak and also decrease from peak to trough by huge margins. Bull episodes are evidenced to last longer than bear episodes making it riskier for investors to hold stocks longer at bull phase (Ogilo, 2008).

Financial theory has laid emphasis on risk as a key predictor of stock returns. According to theory of Markowitz (1952), Modern Portfolio Theory (MPT) and Capital Asset Pricing Model (Sharpe, 1964 and Lintner (1965), financial market players are concerned over a given level of risk and upon which they adjust their returns expectations. Ross (1976) on his Arbitrage Pricing Theory (APT) argued that besides market risk, financial risk is driven by several other factors to determine expected return on investments.

In Kenya, Investors in the Nairobi Securities exchange lost Ksh 157 billion in the first half year of 2015 in a bear run that plunged the main market index to a two year low. According to market data, 48 counters out of 63 lost value with NSE 20 share index falling by 12.7% to 4463 points while absolute investments in this segment fell to Ksh 2.142 trillion (NSE, 2015). In the year of 2015, the stock market performed dismally with the financial sector being the biggest loser while the telecommunications and the agricultural sector proved resilient to the bear run. The banking sector suffered a 12.7% drop to 755 billion in capitalization recording a loss of Ksh 109 billion. Insurance sector shed 20.3% to Ksh 37.5 billion (NSE, 2015). Pension funds reduced their investments in stocks from 30% to 27.1% in first quarter of 2016 due to plunging of the banking stocks due to bad debts and bank failures. The returns of pension firms in Kenya in the past three years reduced by 6.6% (Forbes, 2016).

1.1 Statement of the problem
The increase in stock returns volatilities at post global financial crisis has led to huge loses and uncertainties on stock portfolios to local and international investors. In Kenya, the phenomenon of decline in stock prices and the increasing financial risks in the banking sector has solicited discourses at investors, regulatory and academic circles (Machuke, Mwita &Kihoro, 2014). Investors maximize returns against lowest risk possible. The unprecedented loses has yielded concerns on whether investors at NSE care about risks when making investment decisions. Studies on the influence of financial risk on stock returns are yet to provide a substantial causal link. Sobia, et al. (2015) concluded that interest rates and exchange rates hold negative significant relationship with stock returns. Purnamasari et al. (2012) established that earnings were negative and significantly related to stock returns due to volatility of EPS. Capital risk was significantly related to stock returns while liquidity risk and credit risk proved insignificant to stock returns. Cheng and Nasir (2010) investigated the effect of interest rate, exchange rate, credit risk, solvency risk, market risk and liquidity risk on stock returns. The study established only liquidity risk provided a significant response to stock returns. Kang and Kang (2009), Aga et al. (2013) established reasonable conclusion that financial risk influences stock returns. However, they failed to incorporate combined effect of major financial risk (credit risk, market risk, liquidity risk and capital risk) on stock returns. They also failed to factor the effect of size as a moderator variable on the influence of financial risk on stock returns. These omissions form the basis of this study.

Local studies Kithinji (2010), Lakorito et al. (2014) and Mathuva (2009) have focused on the relationship of financial risk on financial performance. A gap from the existing literature is that they is no study encountered that has considered the influence financial risk on stock returns in Kenya. The risk and return collaborates investors, regulators, researchers and market players to fair play in wealth maximization. Financial markets bridge the gap between investors, hedges and speculators to which this study will be of significance. The principle of no risk no returns stifles wealth creation but again too much of risk is destructive to the economy. Given that there is little or no study in Kenya on how financial risk influence stock returns, it is imperative to explore this gap. The influence of financial risk on shareholder market value on listed banks in NSE forms the subject of this study.

II. LITERATURE REVIEW

2.1 Modern Portfolio Theory
Modern Portfolio Theory (MPT) is a finance theory developed in 1950 by Nobel Prize winner Harry Markowitz. It describes an optimal investment decision as one that maximizes the expected return of a portfolio for a given level of risk, or that investment decision that minimizes portfolio risk for a given amount of portfolio expected return. MPT describe investment as a principle of diversification where a collection of individual risky assets will form a portfolio with overall discounted risk for the same expected return. Stocks and bonds move in opposite directions, but a combination of a stock and a bond will yield a portfolio with overall lower risk for a given return.

MPT theory also observed that a portfolio constituted by positively correlated assets result to lower risk. The theory assume an efficient market with rational risk averse investors; implying that one will only undertake a risky investment only if the returns were commensurate based on individual risk preference. MPT theory defined risk as the volatility of assets prices and the expected return as a collection of weighted asset returns. Harry Markowitz theory (1952) developed a mean variance formulation that combines assets portfolio generate an efficient frontier curve which identifies the optimal portfolio for investment.

Hyde (2007) investigated the sensitivity of stock returns to market risk, interest rate and exchange rates in France, Germany, UK and Italy. The study established that the three risks exhibit a significant influence on excess returns and future cash flows. This empirical study confirms the relevance of modern portfolio theory by aligning the influence of diversified risk on stock returns.

2.2 Arbitrage Pricing Theory
Arbitrage pricing theory (APT) is an asset pricing valuation model that describes stock returns as a function of a series of risk factors. The theory was proposed by Roll and Ross (1976). The
theory is an advancement of Capital Asset Pricing Model (CAPM) by Sharpe and Litter that contended that stock returns are a function of beta risk only. Unlike CAPM, APT describes that stock returns is a factor of a series of risk factors ranging from firm and macro risk factors. Compared to CAPM, APT theory is less restrictive in its assumptions. APT theory assumes the markets are perfectly competitive, Investors prefer more wealth to less with certainty and asset returns follow a stochastic process expressed a linear function of n risk factors. APT theory of n risk factor model can be expressed as below:

\[ E(R_i) = \lambda_0 + \lambda_1b_1 + \lambda_2b_2 + \ldots + \lambda_nb_n \]

\( E(R_i) \) = the expected return on asset I during a specified period of time, \( i=1, 2, 3 \ldots n \)

\( \lambda_0 \) = the expected return on the asset with zero risk

\( \lambda_n \) = the risk premium related to the nth common risk factor; i.e. how responsive is returns of asset i to the nth risk common factor loadings.

Sobia et al. (2015) established that the factor loadings that determine the stochastic process of asset returns over time can be associated with macro and micro economic risk factors.

### 2.3 Conceptual Framework

A conceptual framework employed in the study discusses the foundation that influence of financial risk on stock returns. The dependent variable in the study includes bank stock returns while independent variables were credit risk, market risk, liquidity risk and capital risk. The study entailed a control/moderator variable of bank size. Figure 2.2 represent the study’s conceptual framework.

![Conceptual Framework](image)

**Figure 2.2 Conceptual Frameworks.**

#### 2.3.1 Credit Risk

Aghababaeiet al. (2013) described credit risk as the risk that accrue due to variability of derivatives and debt instruments as a result variations in the quality of advances and the underlying counterparties. In this study credit risk was measured using the ratio of Non-Performing Loans to Gross Loans (NPG). This measure conforms to following empirical studies (Kolapo, Ayeni&Oke, 2012; Abu, Sajeda& Mustafa, 2015).

#### 2.3.2 Market Risk

Market risk is the risk that the value of on and off-balance sheet positions of a bank will be adversely affected by movements in prices or markets rates such as foreign exchange rates, interest rates, credit spreads, equity prices or /and commodity prices leading to a loss in earnings and capital (Sukcharoensin, 2013). In this study market risk was measured using exchange rate operationalized as the annual rate of change of exchange rate between Ksh and USD in accordance to the studies of Sukcharoensin, (2013) and Mouna and Anis (2015).

#### 2.3.3 Liquidity Risk

Saleh (2014) defined liquidity risk as the inadequacy of the liability side of the bank that constraints demand deposit and possibly triggers system fragility and bank runs. It is the uncertainty that arise when a security cannot be liquidated in a market to avert a financial loss. This study adopted funding liquidity risk as a measure of loans to deposit ratio and the ratio of liquid asset to total assets (El Mehdi, 2014; Saleh, 2014).

#### 2.3.4 Capital Risk

Capital risk refers to the risk that the earnings and capital of financial institution is exposed due to lack of risk capital. It is the extent within which bank capital accommodates risk weighted assets (Greuning&Bratanovic, 2009). In this study capital risk is operationalized by the ratio of core capital to risk weighted asset and the ratio of shareholders’ funds to total assets in accordance with the following studies: (Demirguc et al., 2010;Kolapo et al, 2012).

#### 2.3.5 Bank Size

Berger and Brouwnman (2011) determined that bank size, market share and capital can be used as a control variable measured as a log of asset base. They described that bank size is positively related to probability of survival where large banks are less affected by financial crisis compared to smaller banks. During normal times, large banks depict low returns compared to small banks. This explains that the effect of risk and returns in banks is determined by the state of the economy. This observation was supported by Shariat and Khosvari (2008) who observed that firm size is negatively related to stock returns during periods of financial difficulties.

#### 2.3.6 Stock Returns

Stock return is the change in capital or wealth due to an investment. The changes could occur due to cash flows such as earnings, dividends or interest or due to negative or positive changes in prices (Mehri, 2015). To determine stock returns the study employed formula applied by Purnamasari et al. (2012) and Predescu and Stancu (2011) in calculating the stock returns:

**Equation 2.1: Equation Formula on Determination of Stock Returns**

\[ R_{t,t} = \ln \left( \frac{P_t + Div}{P_{t-1}} \right) \]
Where, \( R_{i,t} \) denote the continuously compounded individual bank stock returns at time \( t \). \( P_t \) is the Stock price at the end of the period, \( P_{t-1} \) is the stock price at the end of the previous period and \( Div \) is the cash dividend during the period. Stock return was computed annually from 2006 to 2015. Logarithmic returns are preferred because they are tractable when handling many sub periods for a long horizon. They are also statistical and conform to normal distribution (Mouna&Anis, 2015).

2.4 Empirical Review

Having laid pre-requisite theoretical foundation and conceptual framework defining the association of variables of study; the study reviewed empirical evidence on the influence of financial risk stock returns and related studies by varied scholars.

2.4.1 Credit Risk and Stock returns

Naser et al. (2011) conducted an empirical study to establish the effect of credit and exchange risk on stock returns conditional volatility of banks in Australia using asymmetrical and symmetrical GARCH models. The result of the research found out that there exist meaningful association between credit risk and market risk with stock return volatility. The findings of the study also established that financial risk helps to predict a stock return which is helpful to investors and regulators.

Kithinji (2010) conducted a study on credit risk management on profitability of commercial banks in Kenya. The study covered the period 2004 to 2008 focusing on the amount of credit, level of non-performing loans and profitability. The study found that profitability of commercial banks is not influenced by the amount of gross loans and non-performing loans. The study findings implied that there could other factors that impact on bank profitability. Steiger (2010) examined the influence of stock options and credit risk on stock returns. The study used tradable credit derivatives of credit default swaps and interest rates to measure credit risk. The study established high explanatory power between credit default swaps and stock returns.

Aghababaeiet al. (2013) investigated the effects of credit risk indicators on shareholders’ value of commercial banks listed in Tehran Stock Exchange- Iran. The study covered 6 years from 2005 to 2010 and concluded that credit risk indicators have a significance influence on shareholder value.

Janssen (2012) examined the impact of credit risk on stock returns at the German, French and Dutch stock markets for the period 2004-2012. The objective of the study was to ascertain whether systematic risk embedded on the credit spread affects stock returns. The study found out that there is no significant relationship between excess returns on stocks and credit spreads. Kang and Kang (2009) also conducted a study on the impact of individual firm credit spread and stock returns. They argued that the notion of higher returns on firms with low credit risk than firms with high credit risk is puzzle only applicable during periods of financial distress, otherwise the mean variance theory of higher risk higher returns holds for stable financial periods. That according to the fundamentals of risk versus returns trade off; investor’s undertaking on financial risk is compensated by an investment return premium.

Abu et al. (2015) undertook an empirical study to establish how credit risk affects bank profitability in Bangladesh for the period 2003 to 2013. Credit risk was measured using the ratio of Non-Performing Loans to Gross Loans (NPLGL), ratio of loan loss reserve to gross loans (LLRGL), ratio of Loan Loss Reserve to Non-Performing Loans (LLNRPL) and Capital Adequacy Ratio (CAR). Profitability indicators used included return on asset (ROA) and Return on Equity (ROE). Their finding revealed a negative significant effect of NPLGL and LLRGL on all profitability parameters and a significant negative effect of CAR on ROE concluding that credit risk affects banking profitability in Bangladesh.

2.4.2 Market Risk and Stock returns

Empirical study by Syed & Anwar (2012) provided evidence on the relationship between interest rate and stock returns. It confirmed the existence of significant negative relationship between interest rates and stock returns. In their study on the effects of interest rate, exchange rate and volatilities on stock prices in Pakistan found that exchange rate risk on commercial banks stock returns is significant. They argue that banks will never hedge their individual position perfectly and this exposes them to exchange rate risk.

Ryan and Andrew (2004) conducted a study on market, interest rate and foreign exchange risk in Australian banking sector for the period 1996 to 2001 using GARCH-in-Mean Approach to model stock return volatility on daily Australian stock returns. They concluded that market risk, short and medium term interest rates along with their volatility are a significant determinant of bank stock returns. However, it was found that exchange rates and long term interest rates are not significant in influencing Australian banks stock returns.

Hyde (2007) investigated the sensitivity of stock returns to market risk, interest rate and exchange rates in France, Germany, UK and Italy. The study established that the three risks exhibit a significant influence on excess returns and future cash flows. This empirical study confirms the relevance of and modern portfolio theory by aligning the influence of diversified risk on stock returns. Predescu and Stancu (2011) analyzed portfolio risk in the pretext of global financial crisis using volatility models of ARCH and GARCH along three benchmark indexes of USA, UK and Romania. The objective of the study was to establish the uncertainties in the portfolio over time as a result of financial crisis. Modeling of stock returns volatility of the indexes established that portfolio risk was influenced by systemic forces of the financial crisis. The study also established that diversification of the portfolio along the three indexes during the crisis did not reduce portfolio risk.

Sukcharoensin (2013) conducted a study to examine the influence of market, interest rate and exchange rate on time varying property of Thai banks stocks returns using GARCH framework. The study established that market is a factor of stock return sensitivity to large banks than to small and medium Thai banks. The study also established that interest rate and exchange rate are better predictors of stock returns sensitivity of Thai banks. In the long run, large banks are seen to hedge exchange rate risk and therefore exchange rate risk does not influence there stock return sensitivity.

Mouna and Anis (2015) investigated the effect of market, interest rate and exchange rate risk of financial stock returns during financial meltdown using GARCH-in-Mean model. The study
was conducted for eight countries within USA, European market and China for the period 2006-2009. The study established that market, interest rate and exchange rate positively and negatively influence the volatility of stock returns in USA, China and Europe economies during the financial crisis and concluded therefore that risk forms a component of return.

2.4.3 Liquidity Risk and Stock returns

Dick-Nielsen, et al. (2013) in their empirical study on market liquidity and funding liquidity with regards to Danish bond markets established that funding liquidity determined market liquidity and consequently, market liquidity drives market returns. The study tested for existing relationship between funding liquidity and market liquidity. Fontaine et al. (2013) conducted a study on funding liquidity risk and the cross section of stock returns. The study established that banks diffuse funding shocks to stock returns. The study concluded that low returns are associated with stocks volatility, illiquidity and higher risk premiums.

Mehri (2015) conducted a study on the effects of financial risk on the relationship between earnings and stock returns. The study established a significant positive correlation between earnings and stock returns. It also concluded a negative significant effect of credit risk and capital risk on stock returns but found the effect of liquidity risk on stock returns insignificant. Aga et al.(2013) researched on the association of liquidity ratios and stock returns at Tehran Stock Exchange during 2006 to 2011. The study used external factor of systematic risk and internal factor of company size as control variables. The study found that current ratio can be used to predict stock returns.

El Mehdi (2014) investigated the effects of bank liquidity and financial performance of the Moroccan banking sector. The study defined bank liquidity position over variety of liquidity ratios namely; liquid assets to total assets, liquid asset to total liabilities, liquid assets to deposits, loans to total assets, illiquid assets to liquid liabilities. The study conclusion defined determinants of bank performance as unemployment, bank size, bank liquidity, ratio of external funding to bank liabilities. The study remarked that impact of bank liquidity and performance is depends on the model used.

Saleh (2014) investigated the effect of liquidity risk on bank performance of Jordan banking system. The study established that loans to deposit ratio, current ratio holds a significant relationship on the banks return on equity and return on investments. In general the study concluded that liquidity risk is an endogenous determinant of bank performance in Jordan. Abzari, Fathi and Kabiripour (2013) in their empirical study on effects of illiquidity on capital gain Iranian market evidence. The study confirmed that due to short investments horizons, illiquidity characteristic is a crucial factor for capital gains growth. The study results established that illiquidity inhibits a negative relationship with capital gains. Akram (2014) studied the effects of liquidity on stock returns in Pakistan. The outcomes of the study established that liquidity holds a negative relationship with stock returns.

Chikore et al. (2014) conducted a study on the relationship between stock liquidity and returns at Zimbabwe Securities Exchange. The study used measures of market liquidity namely: bid-ask spread, trading volume and turnover. The results indicated that the volatility of stock liquidity is vital to investors since they use liquidity risk premium in pricing stocks. The study concluded that market liquidity negatively affects stock returns at Zimbabwe Stock Exchange.

Lakorito, Muturu and Nyang’au (2014) conducted and assessment on the impact of liquidity on profitability of banks in Kenya. The results of the study established that liquidity holds a significant positive relationship with banks return on assets. The study described short term liquidity holdings as key in facilitating revenue generation such as meeting demand on deposits and funding of loan obligations.

2.3.4 Capital Risk and Stock returns

Acharya, Hamid and Anjan (2010) in their study of impact of leverage change on firm value developed a model based on Modigliani and Miller Model to explain the reaction of stock returns in association with issuer exchange offers. The study established that positive debt level information influences wealth transfers across security class. Mathuva (2009) study findings supported Central bank of Kenya move to increase bank capital by 2012 to increase efficiency and profitability. The study sought to establish a relationship between Capital adequacy and cost income ratio on performance of commercial banks in Kenya. The empirical study found a significant positive relationship between tier 1 core capital to risk weighted asset ratio and profitability and a negative effect of equity capital ratio on profitability. Berger and Brouwnman (2011) pursued a study on capital effect on bank performance during financial crisis. The study tested the effect of capital on three aspect of bank performance namely: Profitability, Market share and survival; during financial crisis and normal times. The study established capital helps banks of all sizes increase chances of survival, market share and profitability during crisis. In general, the study found that capital is essential at all times for small banks but it’s crucial for medium and large banks during financial crisis.

Wakid, Arab, Madiha, Waseen & Shabeer (2013) studied the impact of capital structure and financial performance on stock returns a case of Pakistan textile industry. They contended that changes in capital structure and financial performance are significant to ascertain the sensitivity of stock returns. Based on their empirical findings, they concluded that capital structure and financial performance positively affects stock returns of Pakistan textile industry.

Kibet, Neddy and Koskei (2013) investigated the effect of capital structure on share prices of energy sector share listed in Nairobi Securities Exchange in Kenya. The study concluded that equity capital is significant but bears a negative effect on stock prices; debt and gearing ratio were significant determinants of share prices. Annas and Mohamoud (2013) investigated the effect of financial leverage and systematic risk on stock returns for industrial sector at the Amman stock exchange for the period 2000 to 2009. Systematic risk was measured by beta coefficient while financial leverage was measured by debt ratio. The study concluded that systematic risk and financial leverage influence 4.4% of the variability in stock returns of the industrial companies listed in the Amman stock exchange which was determined by the study as a negligible effect.
2.3.5 Bank Size and Stock returns
Laeven, Ratnovski and Tong (2014) factored importance of bank size with the scope that large banks profit from economies of scale which promote diversification models and risk reductions. However, during recession, large banks were vulnerable due to unstable funding and risky market activities. Based on these contradictions, policy implications have been suggested to optimize the benefits of large banks and minimize the implications of their down fall which includes capital surcharge, restriction on market based activities and reduction of too big to fail perks.
Aga, et al. (2013) researched on the association of liquidity ratios and stock returns at Tehran Stock Exchange during 2006 to 2011. The study used systematic risk and company size as control variables. The study concluded that both systematic risk and firm size carries a meaningful positive impact on stock returns. Contrary to positive association of bank size to stock returns, Shariat and Khosvari (2008) in their study on impact of stock returns due to size, market factor and book to market ratio, established that firm size hold a negative relationship with stock returns.
El Mehdi (2014) used bank size measured as the log of average assets as a control variable and concluded that as bank size increases, profits persist due to economies of scale and ability to handle financial risk improves thus influencing stock returns positively. For banks, Stable and wider asset base characterize higher profitability resulting to higher stock returns. Aga, et al. (2013) remarked that company size is main cause of variability on shareholder value maximization. In this study bank size is operationalized as the log of bank assets.

2.3.6 Financial Risk and Stock returns
Sobia et al. (2015) executed a study to investigate the effect of financial risk on the sensitivity of stock returns. The study was conducted during the year 2003 to 2012 based on the data of 115 companies at Karachi Stock Exchange in Pakistan focusing on financial risk at industry level, firm specific level and that of exporting and non-exporting firms. Stock return was used as dependent variable while independent variable of financial risk was represented by interest rate, exchange rate, financial exposure, and total risk. Firm size was employed as a control variable. The study findings concluded that interest rates and exchange rates at industry level and firm level hold a negative significant relationship with stock returns while total risk, growth rate, firm size and financial exposure was insignificant on industry and firm level. Interest rates held a positive significant relationship on stock returns for exporting and non-exporting while exchange rate held a negative significant relation for the same group.
Naser et al. (2011) conducted a study to investigate the effect of credit and exchange risk on stock returns of banks in Australia using GARCH family models. The study established that credit risk and market risk influence the behavior of stock returns. The study concluded that credit risk and market risk significantly positive in influencing bank stock returns and therefore the financial risk was useful tool for investors in return maximization.

Haque and Wani (2015) undertook to examine the relationship between financial risk and financial performance of Indian banks. The study also investigated the influence of financial risk on financial performance of Indian banks. Financial risk was defined as interest rate risk, liquidity risk, credit risk, capital risk and solvency risk. The findings established all financial risk studied depicted a relationship with financial performance. The study concluded that solvency risk, credit risk and capital risk significantly influenced financial performance while interest rate and liquidity risk was insignificant to financial performance.
Mehri (2015) investigated the effects of financial risks (liquidity risk, credit risk, and solvency risk) on the relationship between earnings and stock returns. The findings revealed that there exist significant positive relationship between stock returns and earnings. Additionally, credit risk and solvency risk has a negative effect on the relationship between earnings per share and stock returns. Liquidity risk has insignificant effect on the relationship between earnings per share and stock returns.
Puramasari et al. (2012) conducted an empirical research on the effect of financial risk and growth on the relationship between earnings and stock returns. Preliminary findings established that earnings were negative and significantly related to stock returns. This was due to volatility of EPS causing investors to react adversely to bank performance. Solvency risk exhibited a significant relation to earnings and finally to stock returns. The effect of liquidity risk and credit risk proved insignificant to relationship between earnings and stock returns.

III. METHODOLOGY
This study adopted descriptive and correlational research design. Mehri (2015) used descriptive correlational research design in the analysis of effects of financial risks on the relationship between earnings and stock returns. Target population comprised of all 43 commercial banks licensed by the Central Bank of Kenyain operation as at 31st December 2015. Accessible population will comprise of 11 commercial banks licensed by CBK and listed at Nairobi Securities Exchange. The study assumed stratified purposive sampling technique to objectively select sample elements which best represent the population. The sample of secondary data comprised of 9 commercial banks listed in Nairobi Securities Exchange between years 2006 to 2015 namely: Barclay, CFC Stanbic, Diamond Trust, Equity, Housing Finance, Kenya Commercial Bank, National Bank of Kenya, National Industrial Credit Bank (NIC) and Standard Chartered. The study dropped the effects of corporate events such as M & A and rights issues around the announcement dates with an event window of ±10 days. This is because corporate events contain temporary effects on stock returns which are not related to financial risk (Predescu&Stancu, 2011).
10 year annual secondary data for the period 2006 to 2015 was obtained from Kenya National Bureau of Statistics, Nairobi Securities Exchange, Central Bank of Kenya, Listed financial institutions historical financial statement and Banking surveys manuals. Data from Central bank of Kenya was used to show the rate of change of exchange rate between the USD and KSh. Data in financial institutions was used to provide financial ratios that describe respective financial risks. Data on Nairobi securities
exchange was used to calculate the stock returns for the listed banks. The study incorporated method of data collection based on quantitative and qualitative data collection approaches. Econometric techniques were used to describe the influence of financial risk on stock returns of commercial banks listed in Kenya. The data was first subjected to diagnostic test of normality using Jacques Bera test, Breusch-Godfrey test was used to test autocorrelation where acceptance of the null hypothesis for zero autocorrelation was deemed appropriate, stationary test done using Augmented Dickey Fuller test. R statistical software was applied for generalized least square regression analysis. T-test was used to administer for significance of financial risk on stock returns of commercial banks listed in Kenya. The data was first subjected to diagnostic test of stationarity done using Augmented Dickey Fuller t-test. R used to test autocorrelation where acceptance of the null hypothesis at 5% significance level implying unit root does not. We therefore reject null hypothesis and conclude stationarity exist.

Multiple Linear Regression Model
Model on bank size moderating effect on influence of financial risk on stock returns

\[
R_{it} = \alpha_0 + \beta_1 FR_{it} + \beta_2 ZS_{it} + \beta_3 FR_{it} \times ZS_{it} + \epsilon_{it}
\]

Full Model Specification

\[
R_{it} = \alpha_0 + \beta_1 NPG_{it} - \beta_2 FX_{it} - \beta_3 LDR_{it} - \beta_4 CWA_{it} + \beta_5 ZS_{it} + \epsilon_{it}
\]

Where:

- **R** = Stock Returns
- **NPG** = Ratio of Non-Performing Loans to Gross Loans measuring credit risk
- **FX** = Rate of change of Exchange rate between Ksh and USD measuring market risk
- **LDR** = Ratio of Loans to Deposit measuring liquidity risk
- **CWA** = Ratio of Core Capital to Weighted Average Asset measuring capital risk
- **FR** = Composite Financial Risk (Average ratio of NPG, FX, LDR, and CWA)
- **ZS** = Bank Size denoted as log of asset base
- **FR*ZS** = Interaction term between bank size and financial risk denoting moderating effect of the moderator variable
- **\(\epsilon\)** = Error term and
- **\(\alpha\)** = constant
- **\(\beta\)** = coefficient of independent variables

IV. DATA ANALYSIS AND DISCUSSIONS

4.1 Descriptive Results

Table 4.1 provides the summary of descriptive statistics of the sample showing mean, standard deviation, skewness, kurtosis, minimum and the maximum of the study variables. The results show that a 10 years investment in the banking stocks obtained an average stock return of 6.34% with a deviation of 3.52%. The banking industry average credit risk measured by ratio of non-performing loans to gross loans (npg) averaged 6.4% slightly below the industry bench mark of 7% with a deviation of 3%. Market risk (fx) increase during the ten year period as evidenced by 3.02% devaluation of ksh against the USD. Market risk returned the highest deviation of 9.26% compared to other variables. On liquidity risk, bank held their ratio of loans to deposit by average 74.03% with a deviation of 4.4%. The liquidity risk ratio (ldr) was higher than the industry practice of 60% implying listed banks were trading dangerous on liquidity. Capital risk measured by the ratio of core capital to risk weighted assets (cwa) was held at an average 14.81% which is remarkably higher than 8% regulatory bench mark. The deviation of capital ratio for the period was 0.96% indicating solid capital base by the listed banks. Bank size average 14.3 billion measured in log of asset size (ZS) with a deviation of 0.5359 billion.

Table 4.1 Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Min.</th>
<th>Max.</th>
<th>ZS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>0.0634</td>
<td>0.0640</td>
<td>0.0302</td>
<td>0.74025</td>
<td>0.1481</td>
<td>0.14384</td>
<td></td>
</tr>
<tr>
<td>NPG</td>
<td>0.1572</td>
<td>0.0600</td>
<td>0.0253</td>
<td>0.74395</td>
<td>0.1494</td>
<td>0.14451</td>
<td></td>
</tr>
<tr>
<td>FX</td>
<td>0.4929</td>
<td>0.1410</td>
<td>0.2074</td>
<td>0.833</td>
<td>0.1615</td>
<td>0.15106</td>
<td></td>
</tr>
<tr>
<td>LDR</td>
<td>0.9597</td>
<td>0.0367</td>
<td>0.0933</td>
<td>0.6872</td>
<td>0.1307</td>
<td>0.13480</td>
<td></td>
</tr>
<tr>
<td>CWA</td>
<td>0.3520</td>
<td>0.0307</td>
<td>0.0925</td>
<td>0.0439</td>
<td>0.0096</td>
<td>0.05359</td>
<td></td>
</tr>
</tbody>
</table>

4.2 Diagnostic Test

Normality Test was conducted using JarqueBera test. The test obtained a p-value of above 5% level of significance for all variables apart from credit risk variable (npg). The exception of non-normality was solved by the generalized least square model. The results of the test are shown in table 4.1. To test for stationarity, the study used Augmented Dickey Fuller test. Results in table 4.2 show the ratio of non-performing loans, ratio of loan to deposits and ratio of core capital to risk weighted assets were stationary at order 1, 0, 0 respectively. Stock returns and rate of change of exchange rate were found non stationary at order 0 and 1 with a p-value of 0.008 and 0.0079 respectively. Stationarity was determined at a point where ADF t-statistic is lower than the critical value at 5% significance level implying unit root does not. We therefore reject null hypothesis and conclude stationarity exist.

Table 4.2 ADF Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test at Levels</th>
<th>ADF Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>order</td>
</tr>
<tr>
<td>Returns</td>
<td>z.lag.1 &amp; Intercept</td>
<td>0</td>
</tr>
<tr>
<td>Non-Performing Loans</td>
<td>z.lag.1 &amp; Intercept</td>
<td>1</td>
</tr>
<tr>
<td>Rate of change of foreign exchange</td>
<td>z.lag.1 &amp; Intercept</td>
<td>2</td>
</tr>
<tr>
<td>Ratio of loan to deposit</td>
<td>z.lag.1 &amp; Intercept</td>
<td>0</td>
</tr>
</tbody>
</table>
Ratio of core capital to risk weighted assets  
z.lag.1 & Intercept  
0 -0.1839 -1.95  0.8587

Autocorrelation test for time series data was done using Breusch Godfrey test. This test was ideal since it accommodate for higher lag orders of residuals unlike Durbin Watson which is based on lag 1 order of residuals. A table 4.3 shows result of the test with a p-value of 0.1447 which was higher than 5% level of significance. This results imply that we accept the null hypothesis that autocorrelation does not exist.

Table 4.3 Breusch-Godfrey Test  
| Statistic | 2.1269 |
| P-value   | 0.1447 |

Pearson correlation test was done to confirm the degree of multi-collinearity amongst the variables. Table 4.4 revealed stock returns are positively correlated to credit risk and capital risk and negatively correlated to market risk, liquidity risk and bank size. The test held correlations coefficients of 0.099, -0.498, -0.224, 0.081 and -0.09 for credit risk, market risk, liquidity risk, capital risk and bank size respectively. The highest positive correlation is 0.099 while the highest negative correlation was -0.498 implying absence of multi-collinearity among selected variables.

Table 4.4. Correlations Matrix

<table>
<thead>
<tr>
<th>Correlations Parameter</th>
<th>Rt</th>
<th>npg</th>
<th>fx</th>
<th>ldr</th>
<th>cwa</th>
<th>zs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rt</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>npg</td>
<td>.099</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fx</td>
<td>-.498</td>
<td>-.353</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ldr</td>
<td>-.224</td>
<td>.050</td>
<td>.171</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cwa</td>
<td>.081</td>
<td>-.365</td>
<td>.024</td>
<td>-.021</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>zs</td>
<td>-.090</td>
<td>-.717*</td>
<td>.423</td>
<td>.535</td>
<td>.233</td>
<td>1</td>
</tr>
</tbody>
</table>

Observations 10 10 10 10 10 10

Lastly, we examined the errors terms for constant variance using Breusch-Pagan test at 5% level of significance. Test results as shown in table 4.5 below indicate that there was no enough evidence to reject the null hypothesis for presence of constant variance. This therefore means that there was uniform variance in the error terms which is appropriate for the model.

Table 4.5 Breusch-Pagan Test  
| Statistic | 4.3615 |
| P-value   | 0.4986 |

4.3 Regression analysis and hypothesis testing  

4.3.1 Influence of credit risk on stock returns  
To examine the influence of credit risk and stock returns, the study regressed the ratio of non-performing loans to gross loans (npg) as independent variable against stock returns (R_{it}). Table 4.6 shows GLS regression results. Based on correlation structure of ARMA (2, 1) the influence of credit risk on stock returns was found to be positively significance with a p-value of 0.0268 lower than α =0.05. The significant relationship of credit risk on stock returns conforms to risk-return relationship under stable economic environment, according to Modern Portfolio Theory. This finding corresponds to the study of Kang & Kang (2009). The null hypothesis is therefore rejected that credit risk does not influence the stock returns of commercial banks listed in Nairobi Securities Exchange.

Table 4.6: Regressing NPG on R_{it}  
<table>
<thead>
<tr>
<th>Predictors</th>
<th>Dependent Variable : Stock Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient Value</td>
<td>Standard Error(S.E)</td>
</tr>
<tr>
<td>npg</td>
<td>1.003965</td>
</tr>
</tbody>
</table>

Significance of influence of credit risk on stock returns conforms to the study of (Naser et al., 2011; Mehri, 2015; Kang & Kang, 2009). Positive association was related the study of Alshatti (2015) who found credit risk positively related to stock returns. This is contrary to the study of Naser et al. (2011) which established credit risk is negatively related to stock returns. The final model of study can be concluded shown as below.

\[ R_{it} = -1 + 1.003965 \text{NPG} \]

4.3.2 Influence of market risk on stock returns  
To establish the influence of market risk on stock returns, the study regressed the rate of change of exchanges rate on KES against US (fx) as independent variable against stock returns (R_{it}). Table 4.7 shows the Generalized Least Square regression results. Based on correlation structure of ARMA (2, 2), the influence of market risk on stock returns was found to be positively significant with a p-value of 0.0414 which is lower that 5% level of significant net of constant. This finding is in accordance to the theory of Modern Portfolio Theory. The null hypothesis is therefore rejected that market risk does not influence the stock returns of commercial banks listed in Nairobi Securities Exchange.

Table 4.7: Regressing FX on R_{it}  
<table>
<thead>
<tr>
<th>Predictors</th>
<th>Dependent Variable : Stock Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient Value</td>
<td>Standard Error(S.E)</td>
</tr>
<tr>
<td>fx</td>
<td>1.326789</td>
</tr>
</tbody>
</table>

which found exchange rate positively or negatively related to stock returns depending with the period and hedging capacity of the bank. This is contrary to the studies Ryan and Andrew (2004) that held foreign exchange insignificant to stock returns. The study model is concluded below as:

\[ R_i = -1 + 1.326789 \times FX \]

4.3.3 Influence of liquidity risk on stock returns

In order to determine the influence of liquidity risk on stock returns, the study regressed bank loans to deposit ratio as independent variable against stock returns (\( R_i \)). Table 4.8 shows generalized least square regression. Based on correlation structure of ARMA (2, 1), the influence of liquidity risk on stock returns was found to be positive conforming to liquidity preference theory that foregoing, liquidity must be compensated with a premium under stable economic conditions otherwise the relationship is negative. Table 4.3 shows t-test result with a p-value of 0.0095 which is lower than 5% level of significance net of constant. The findings implied that there existed a significant relationship between liquidity risk and stock returns. The null hypothesis is therefore rejected that liquidity risk does not influence the stock returns of commercial banks listed in Nairobi Securities Exchange.

Table 4.8: Regressing LDR on \( R_i \)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Dependent Variable: Stock Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient Value</td>
<td>Standard Error(S.E)</td>
</tr>
<tr>
<td>ldr</td>
<td>0.08352745</td>
</tr>
</tbody>
</table>

The significant influence of liquidity risk on stock returns conformed to the study of Aga et al. (2013), Dick-Nielsen, et al. (2013), and Cheng and Nasir (2010). Positive association was related to the study of Janssen (2012) which found liquidity risk was positively related to stock returns. Akram (2014) established liquidity risk to have a negative influence on stock returns. Contrary, Mehri (2015), Purnamasari et al. (2012) and Haque and Wani (2015) established liquidity risk was not significant to stock returns. The final model of study can therefore be concluded as:

\[ R_i = -1 + 0.08352745 \times LDR \]

4.3.4 Influence of capital risk on stock returns

To assess the influence of capital risk on stock returns, the study regressed the ratio of core capital to risk weighted asset (CWA) as independent variable against stock returns (\( R_i \)). Table 4.9 show the regression results from generalized least square method. Based on correlation structure of ARMA (2, 1), the influence of capital risk on stock returns was found to be negatively significant with a p-value of 0.0108 net of the constant. The regression results confirmed that there exists a significant influence of capital risk on stock returns. The null hypothesis is therefore rejected that capital risk does not influence the stock returns of commercial banks listed in Nairobi Securities Exchange.

Table 4.9: Regressing CWA on \( R_i \)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Dependent Variable: Stock Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient Value</td>
<td>Standard Error(S.E)</td>
</tr>
<tr>
<td>cwa</td>
<td>0.08352745</td>
</tr>
</tbody>
</table>

The significance of influence of capital risk on stock returns was related to the study of Purnamasari et al. (2012), Mehri (2015), Acharya et al. (2010), and Wakid et al. (2013). Positive association was found related to the studies of Acharya et al. (2010) and Wakid et al. (2013). However, the findings were contrary to the study of Mehri (2015) that established that capital risk/solvency risk bears a negative correlation to stock returns. Annas and Mohamoud (2013) established that the relationship between financial leverage and stock returns held a negligible effect. The final model of study can be concluded as:

\[ R_i = -1 + 0.08352745 \times CWA \]

4.3.5 Moderating effect of bank size on the influence of financial risk on stock returns

In order to determine the moderating effect of bank size on the influence of financial risk on stock returns, the study regressed a composite factor of financial risk (FR), bank size (ZS), and moderating factor (FR*ZS) against stock returns (\( R_i \)). Table 4.10 show the regression results from generalized least square method. Using a correlation structure of ARMA (3, 3), the moderating effect of bank size on the influence of financial risk on stock returns was found negatively significant with a p-value of 0.0254 which is lower than 5% level of significance net of constant. The results indicated that large banks are likely to be affected more during depressions period. The regression results concluded that there exists moderating effect of bank size on the influence of financial risk on stock returns. The null hypothesis is therefore rejected that bank size does not have a moderating effect on the influence of financial risk on stock returns of commercial banks listed in Nairobi Securities Exchange.

Table 4.10: Regressing FR, ZS, FR*ZS on \( R_i \)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Dependent Variable: Stock Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient Value</td>
<td>Standard Error(S.E)</td>
</tr>
<tr>
<td>fr</td>
<td>16.3443</td>
</tr>
<tr>
<td>zs</td>
<td>46.6624</td>
</tr>
<tr>
<td>fr*zs</td>
<td>-423.3927</td>
</tr>
</tbody>
</table>

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The significant negative moderating effect of bank size on the influence of financial risk on stock returns builds up on empirical evidence that risk in small firms is easily managed compared to risk in large firms especially during periods of depressions. These findings are therefore related with study of Shariat and Khosvani (2008). However, the study findings contradict with the studies of Aga et al. (2013) and Laeven et al. (2014).

4.3.6 Influence of financial risk on stock returns

To determine the influence of financial risk on stock returns, the study through GLS model regressed predictor variables: credit risk (npg), market risk (fx), liquidity risk (ldr), capital risk (cwa) and bank size (zs) on stock returns (rit). Full model regresses all predictor variables including bank size as the control variable as presented in table 4.11. The results indicated negative coefficients compared to the regression model based on individual variables (risks) which exhibited a positive coefficient on stock returns as outlined by tables 4.6, 4.7, 4.8 and 4.9. All coefficients of financial risk in the full model regressed collectively carried a negative sign indicating that when risk is combined, it bears a systemic effect to the point where any increase in risk results into a decrease in stock returns. The model coefficient signifies the rate of change of the dependent variable for every 1 unit change on the explanatory variable ceteris paribus. Stock returns (Rit) decreases by -5.14 (-) for every increase in 1 unit of credit risk in the full model. Comparable illustrations can be deduced with other coefficient values except for the control variable of bank size which bears a positive coefficient of 0.6 indicating that large banks are likely to be less affected by risk hence high returns.

Regression Model: Full Model

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Dependent Variable : Stock Returns</th>
<th>Coefficient Value</th>
<th>Standard Error(S.E)</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>npg</td>
<td>-5.1437</td>
<td>1.20808</td>
<td>-4.2578</td>
<td>0.0080</td>
<td></td>
</tr>
<tr>
<td>fx</td>
<td>-6.2034</td>
<td>1.134326</td>
<td>-5.4688</td>
<td>0.0028</td>
<td></td>
</tr>
<tr>
<td>ldr</td>
<td>-7.8726</td>
<td>2.292468</td>
<td>-3.4341</td>
<td>0.0186</td>
<td></td>
</tr>
<tr>
<td>cwa</td>
<td>-22.0239</td>
<td>4.88892</td>
<td>-4.5048</td>
<td>0.0064</td>
<td></td>
</tr>
<tr>
<td>zs</td>
<td>0.6690</td>
<td>0.16156</td>
<td>4.1412</td>
<td>0.0090</td>
<td></td>
</tr>
</tbody>
</table>

Based on the GLS regression (full model), the study tested the collective influence of financial risk on stock returns incorporating the control variable of bank size. The model established that influence of credit risk (npg), market risk (fx), liquidity risk (ldr) and capital risk (cwa) on stock returns was negatively significantly with a correlation structure of ARMA (p=2, q=0) with p-values of 0.008, 0.0028, 0.0186 and 0.0064 respectively. The control variable of bank size on stock returns was found positively significant with a p-value 0.009. The results of the p-values on the t- test statistics was lower than α =0.05 and hence the general conclusion of study that financial risk influences stock returns for commercial banks listed at Nairobi security exchange. This signifies that investors consider financial risk and bank size critical components in their investment decisions.

The results from the collective GLS regression model are negatively significant which is contrary to single variable regression of financial risk on stock returns which indicated a positive correlation with stock returns (Table 4.3.1 to 4.3.4). The findings illustrate that under an environment of combined financial risk, the pro-cyclicality of financial risk and the contagion of systemic effect negates the benefits of incurring incremental risk to boost returns. These findings are in line with theoretical foundations of MPT theory and related to empirical studies according to Sobia et al. (2015), Naser et al. (2011), Mehri (2015) and Haque and Wani (2015). The resultant model can hence be stated as:

\[
R_{it} = -1.5.144 \cdot NPG -6.2035 \cdot FX - 7.873 \cdot LDR - 22.0239 \cdot CWA + 0.6691 \cdot ZS
\]

The model can be interpreted to mean that other factors held constant a marginal increase in credit risk (NPG) would results to a marginal decrease of stock returns (Rit) by 5.143781. The same can be said regarding market risk (FX), liquidity risk (LDR) and capital risk (CWA). However a marginal change in one unit of bank size (ZS) would leads to an increase in 0.669069 of stock returns.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

5.1 Summary of Findings

5.1.1 The influence of credit risk on stock returns

Hypothesis testing results indicated that credit risk measured by the ratio of non-performing loans to gross loans negatively and significantly affect stock returns when regressed alongside other financial risks. The results met the expectation of study and conform to the basics of Modern Portfolio Theory and agency theory. The results are similar to Naser et al. (2011). However, the direction of influence was opposite when credit risk was regressed individually on stock returns. This signifies that over a long period, ignoring presence of other financial risk and size of the financial institution under stable conditions; credit risk will boost investment in stocks. This is in line with the study of Alshatti (2015) which found credit risk is positively related to stock returns. Overall indication is that investors consider non-performing loans as a critical aspect in their investment decisions.

5.1.2 The influence of market risk on Stock returns

GLS regression result on the influence market risk on stock returns confirmed a negative significant relationship when regressed alongside other variables of financial risk and bank size. This signifies that bank size and all risk put together bears a cyclical and systemic effect that yields a negative effect of market risk on stock returns. Similarly, under depressed economic conditions, any additional risk is undesirable as it reduces shareholder market value. This result conforms to theoretical framework of risk versus returns in Modern Portfolio Theory.

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Theory. The findings are also related with the conclusions according to Sobia et al. (2015) and Mouna and Anis (2015). Individual regression of market risk on stock returns indicated that an increase in market risk will increase stock returns. The results conform to relationship of risk and returns during stable economic period. These results are related to the findings of Naser et al. (2011). Cheng and Nasir (2010) established a contrary view that market risk is not significant on stock returns. Overall conclusion of the study is that market risk influences stock returns at Nairobi Securities Exchange. The significance of either or both direction depending on period is supported by Mouna and Anis (2015), Syed & Anwar (2012) and Cheng and Nasir (2010).

5.1.4 The Influence of capital risk on stock returns
GLS regression result on the influence capital risk on stock returns confirmed a negative significant relationship when regressed collectively with other financial risk. The results signify that holding too much money on capital is detrimental to shareholder market value. These results could signify adverse effects of the increased cost of leverage on stock returns. Study findings conform to Static theory of capital and Capital structure puzzle by Myers (1984). It also conforms to trade off theory of capital structure where the cost of distress is said to supersede tax advantage. The findings are related with the conclusions made in the study of Acharya et al. (2010). The results based on individual regression of capital risk on stock returns showed that an increase in capital adequacy will increase stock returns. These results related to the findings of Mehri (2015) and Berger and Brouwman (2011) that banks with solid capital are probable to have a diversified and broad risk appetite leading to higher incomes, dividends and consequently high capital gain due to demand on their stocks. Overall, the study concluded that capital risk influences stock returns. The direction of significance on influence of capital risk was established to depend on the period and this is supported by Wakid et al. (2013), Anas&Mohamoud (2013) and Purnamasari et al. (2012).

5.1.5 The Moderating effect of bank size on the influence of financial risk on stock returns
Hypothesis testing result on the effect bank size on stock returns revealed a positive and significant relationship. This result implies that big banks categorized by the size of assets are able to withstand a higher risk appetite. The results also imply big banks are in a position to diversify risk culminating to discounted risk exposure associated with a risk premium. This finding conforms to the study of Berger and Brouwman (2011), El Mehdi (2014) and Aga, et al. (2013). From the findings investors seem to prefer large banks because they are resilient to systemic and related financial risk. Large banks are found permissible to diversify their portfolio and therefore reduce their overall risk on their investment (Laeven et al., 2014).

The result on moderating effect of bank size on the influence of financial risk on stock returns indicated that bank size as moderator is negatively significant in influencing the effect of financial risk on stock returns. These findings indicate that although bank size is key in enabling a bank to risk appetite and diversify, during depressed economic conditions, large banks are highly suspect to shareholder market value due financial risk as was the case during financial crisis (Shariat&Khosvari, 2008; Laeven et al., 2014).

5.1.6 Influence of financial risk on Stock returns
GLS regression model based on 10 years secondary data from 2006 to 2015 was done between financial risk and stock returns. Individual variable regression indicated that for the past 10 years an increase in stand alone risk leads to an increase in stock returns. This is likely to indicate a growth period during the 10 years which is orchestrated by a resilient banking industry favourable economic enviroment. Multiple regression of financial risk on GLS regression model indicated that financial risk bears a negative significant effect on stock returns. This is due to joint effect of financial risks on stock returns. Joint effect of financial risk is pro-cyclical and systemic. Credit risk is triggered by increase in market risk; caused by increasing non-performing loans and high provisions. High credit risk constrain funding liquidity which consequently affects capital adequacy of banks. Large banks were found resilient on financial risk compared to small banks. Overall conclusion of the regression model confirmed that financial risk influence stock returns of commercial banks listed at Nairobi Securities Exchange where individual risk are positively significant to stock returns while the combined effect of multiple financial risk is negatively significant. This conclusion is in line with theoretical foundations of MPT theory and related to empirical studies supporting this study of Sobia et al. (2015), Naser et al. (2011), Mehri (2015) and Haque and Wani (2015).

5.2 Conclusion
The study make conclusions based on the findings with regards to objectives of study to establish the influence of financial risk on stock returns of commercial banks listed in Kenya.

The study concludes on the first objective on influence of credit risk on stock returns that the portfolio at risk increased with increased in stock returns. However, when looked at alongside other financial risk the relationship is negative. This is evidence that bank top leadership need to establish the optimal level of credit risk to ensure maximum shareholder return.

The influence of market risk on stock returns was concluded to have a positive relationship with stock returns when evaluated in isolation. That increase in foreign exchange exposure in the balance sheet of commercial banks and consequent depreciation of the Ksh vs Usd, triggers positive returns for investors in the banking industry. Foreign exchange exposure combined with other financial risk yield a negative relationship with stock returns. The study indicate that when faced with multiple financial risk, banks need to hedge some of the risk to minimize on adverse impact on the shareholder market value.

Liquidity risk and Capital risk individually influence stock return positively. This is an indication that investors prefer banks to hold minimum liquidity and capital and invest the surplus funds. However, in presence of other risk, adequate liquidity and capital is vital. Bank size plays a crucial role for investors. The study concludes that big banks are well prepared to handle risk.

The study summarised with a conclusion that financial risks are systemic and pro-cyclical and therefore banks should establish optimal thresholds and risk appetites to safeguard shareholder market value. When risk is too much bank are advised to consider appropriate hedging strategies.

5.3 Recommendations

The subject of financial risk and stock returns is critical to management of commercial banks and policy framework governing financial institutions in Kenya. On the significance of influence of credit risk on stock returns, the study recommends bank top management to profile the risk of borrowers and define the risk appetite for lending. Adequate provisions should be set aside to write-off bad loans without affecting the going concern of the bank. Policy makers and supervisory arms on the other hand should provide an oversight role to ensure banks are complying with general and specific provisions.

On market risk, banks should hold balanced and adequate amount of loans and deposits denominated in foreign currency held in their book. Central bank of Kenya monetary policy should regulate the Ksh vs USD rate of exchange bearing in mind the exposures in the banking sector. They should always seek to control the volatility of the exchange rate.

Bank managers should provide for adequate liquidity for banks to meet short term liquidity requirements. The ratio of loans to deposit should be optimal enough to allow lending and enable banks meet customers daily requirements. Central banks should ensure the proportion of banks assets held in government securities are adequate for to meet bank’s emergency cash requirement. Manager should also undertake to ensure banks are holding adequate capital by building reserve and ploughing bank profits to build sufficient risk capital to suport day to day bank operations, providing for unexpected loses and contingencies.

Central bank supervisory arm may use the findings of study to establish a graduating scale of capital therehold.

5.4 Areas for further research

In the global financial enviroment, the impact of financial risk on stock returns will keep on changing. Further research on influence of financial risk measured as a funtion of derivative products such as credit spreads on stock returns could be explored. Similarly, a comparative study of financial risk on stock returns with other emerging market should be explored. As far as the knowledge of the resercher, this is a pioneer study in Kenya as previous studies have only focused on the effect of financial risk on financial performance and effect of macro-economic on stock returns. These study focused on macro-economic factor and internal institution factors thus taking a holistic approach of financial risk affecting commercial banks in Kenya.

REFERENCES


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Methanol Poisoning in Various Counties of Kenya, 2014

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Abstract- Background: Methanol poisoning is the toxicity that results from ingestion, inhalation or absorption of methanol. Methanol toxicity remains a public health problem in many parts of the developing world, including Kenya. An outbreak was notified to the disease surveillance and response unit, Kenya in May 2014. FELTP, Kenya was requested to carry out the investigation.

Methods: We conducted a cross-sectional study between 28th May and 12th June 2014, to describe the distribution of the methanol poisoning cases, to assess methanol case management in affected facilities and to assess the disaster and emergency preparedness of the affected counties. A case was defined as a person who had consumed illicit brew or presented with signs and symptoms clinically compatible with methanol poisoning in Embu, Makueni, Kitui, Nakuru, Narok, Nyandarua and Kiambu Counties within 72 hours after consuming illicit brew in the month of May 2014.

Data was obtained through retrospective review of health records, key informant interviews and case tracing. Epi Info 7 was used for data analysis.

Results: We enrolled 278 cases of whom 106 (38%) were traced. Sixty-eight had died constituting a case fatality rate of 27 %. Males constituted 253(91%) and 80(53%) were married. The mean age of the patients affected was 37±12 years. Ninety (32%) were from Embu County. Two hundred fifty-six (92%) cases had sought medical attention, the main presentation being abdominal pain (41%, n=105). Cases were mainly treated with intravenous fluids (75%, n=193) and ethanol (53%, n=138). Eight facilities (67%) detected the outbreak through abnormal number of cases or deaths received at outpatient. The main responses involved health education campaigns (67%, n=8), mobilization of emergency supplies (50%, n=6) and coordination (42%, n=5).

Conclusion: Methanol poisoning is problem of public health importance in Kenya. There are no guidelines, flow charts and protocols to harmonize case detection, diagnosis and management and linkages to rehabilitation services. Preparedness and response to disasters is fair across facilities. We therefore recommend health education and behavior change communication in affected counties; technical support from the disaster preparedness unit during disasters and emergencies, establishment of guidelines, flow charts and protocols to harmonize case detection, diagnosis, management and rehabilitation of cases.

Index Terms- Methanol, Poisoning, Counties, Kenya,

I. INTRODUCTION

Methanol poisoning is the toxic effect of ingestion, inhalation, or absorption through the skin of methanol (methyl alcohol, wood alcohol) that may impair the central nervous system; causing severe acidosis, blindness, and shock; and result in death(1). Methanol is a constituent of many commercially industrial solvents and of poorly adulterated alcoholic beverages(2). Almost all cases of methanol toxicity result from ingestion, though rarely, cases have followed inhalation or dermal absorption. When ingested, absorption is rapid and peak methanol concentrations occur within 30-60 minutes. Methanol itself is harmless, but becomes toxic when converted in vivo into formaldehyde and formic acid. Methanol is oxidized by alcohol dehydrogenase to formaldehyde which is further oxidized to formic acid by formaldehyde dehydrogenase. Final breakdown of formic acid facilitated by 10-formyl tetrahydrofolate synthetase produces carbon dioxide and water. The acidosis that occurs in methanol poisoning appears to be caused directly or indirectly by formic acid. There is a direct correlation between formic acid concentration and increased morbidity and mortality (3). The prognosis of methanol poisoning is dependent on the amount ingested and the subsequent degree of metabolic acidosis(2). According to WHO, 3.3 million die every year due to harmful use of alcohol, representing 5.9% of all deaths(4). Global, regional and country estimates of methanol poisoning burden are not documented, but methanol toxicity remains a common problem in many parts of the developing world especially among members of lower socio-economic classes. Recent outbreaks have been reported in Cambodia, Czech Republic, Ecuador, Estonia, India, Indonesia, Kenya, Libya, Nicaragua, Norway, Pakistan, Turkey and Uganda. The size of these outbreaks has ranged from 20 to over 800 victims, with case fatality rates of over 30% in some outbreaks (5).
Mass methanol poisonings occur when methanol is added to illicit alcoholic drinks. Such outbreaks can rapidly overwhelm health facilities. High concentrations of methanol arise when distillation process is not well managed, but more importantly when methanol is added to fortify informally-produced spirits and counterfeit alcoholic drinks. Often such drinks are sold in unlabeled containers or made to appear legitimate through bottle design and labelling such that consumers falsely believe that they are genuine alcoholic drinks. These alcoholic drinks are often cheap and therefore attractive to the low socio-economic class. Often victims delay in seeking medical care mainly because there is a latent period between ingestion and onset of toxic effects. Late presentation contributes to the high levels of morbidity and mortality experienced with methanol poisoning outbreaks (5).

Methanol typically induces nausea, vomiting, abdominal pain and mild central nervous system depression. There is often a latent period lasting approximately 12-24 hours depending on methanol dose ingested following which an uncompensated metabolic acidosis develops and visual function is impaired ranging from blurred vision, altered visual fields to complete blindness (3). The toxic dose of methanol varies between individuals. A blood concentration of more than 500mg/l is associated with severe toxicity while concentrations above 1500-2000mg/l will lead to death in untreated patients (6). Humans have limited ability to detoxify formic acid and this metabolite therefore accumulates and causes toxic effects. Co-ingestion with ethanol delays metabolism, delaying the onset of toxicity (7). Onset of toxicity often begins with drowsiness; the victim becomes unsteady and disinhibited. This is often ignored since it occurs in the context of drinking alcohol. Victims may thereafter experience hyperventilation and feeling of breathlessness. Coma, convulsions and finally death may result from respiratory arrest (6).

Diagnosis can be made by measuring the amount of methanol in blood, although this may not be available in most treatment centres. Presence of methanol increases the osmolality of blood as does ethanol. As poisoning progresses, the concentration of methanol in blood slowly decreases and that of its metabolites including formic acid begin to rise. Metabolic acidosis with high anion gap is the chemical characteristic of methanol poisoning upon biochemical analysis. It is often easier to measure formic acid during diagnosis than methanol (8). In summary, diagnosis can be made from history, presenting signs and symptoms, metabolic acidosis, elevated anion gap, elevated osmolar gap, presence of methanol and formic acid in serum assay (6).

The main therapeutic principles include prevention of further breakdown of methanol, correction of metabolic acidosis and supportive care. Specific therapeutic measures include correction of the metabolic acidosis with intravenous sodium bicarbonate and administration of enteral or parenteral ethanol or Fomepizole to competitively inhibit the metabolic breakdown of methanol to formic acid (2). Fomepizole, a potent Alcohol Dehydrogenase Inhibitor has largely replaced the antidotal ethanol use in France and two prospective U.S. trials definitely established its efficacy. Fomepizole appears safer than ethanol and is therefore recommended as the first-line antidote. However, ethanol is cheaper in comparison with the relatively high cost of Fomepizole. Administration of folic or folinic acid enhances the metabolism of formic acid. The summary below shows the basic antidotes that may be useful at the different phases of methanol metabolism (9). Figure 6. Intubation for mechanical ventilation and hemodialysis removes the toxic metabolites (3).

During methanol poisoning outbreaks, occurrence of more than three cases in one area within 24 hours is considered an outbreak. Rapid diagnosis of methanol poisoning incidence and public information through local media is important in prevention of methanol poisoning morbidity and mortalities. Active case finding is necessary to access at risk patients who, otherwise, would not access a hospital. This is performed in consultation with the patients and their relatives (9).

Methanol poisoning is a problem of public health concern in Kenya. It occurs frequently among young adult single males who are primary school dropouts, mainly casual manual workers whose main aim of drinking is to release stress. Several outbreaks have occurred often with fatal mortality and other associated complications. In August 1998, more than 80 people died in Nairobi after drinking 'chang’aa'; in November 2000, 512 people were admitted in Kenyatta National Hospital, of whom 137 died, 20 lost sight; in July 2005, 50 people in Machakos died after consuming Chang’aa. These episodes have occurred especially when desperate brewers intentionally substitute methanol containing substances for ethanol (10). Twelve people died in Nairobi’s Shaurimoyo estate in April 2010, 5 died in Thindigua, Kiambu County in July 2010, 23 died in Kibera, Nairobi in August 2010, and 5 died in Laikipia County in August 2010. In Kenya, alcohol is regulated by NACADA authority under the Alcoholic drinks control Act of 2010. The body regulates production, manufacture, sale, labelling, promotion, sponsorship and consumption of alcoholic drinks (11). One of the largest outbreaks occurred in the month of May 2014 after consumption of illicit brew in Embu, Kitui, Makueni, Nakuru, Nyandarua and Kiambu counties, where 155 cases were reported. The directorate of preventive and promotive health services through Disease surveillance and response unit was notified of the outbreak. The unit requested FELTP team to carry out the investigation. The aim of the investigation was to describe the methanol poisoning cases, assess the care management of victims, and evaluate the emergency and disaster preparedness of affected counties.

II. MATERIALS AND METHODS

Study sites
Study design: A cross-sectional study was carried out involving a retrospective review of medical records and administration of questionnaire to key informants including health workers, friends, relatives of cases that had died and survivors.

Case definition: During the investigation, a case was defined as follows: A person who had consumed illicit brew or presented with signs and symptoms clinically compatible with methanol poisoning in Embu, Makueni, Kitui, Nakuru, Narok, Nyandarua and Kiambu Counties within 72 hours after consuming illicit brew in the month of May 2014.

Sampling
All cases meeting the case definition criteria were included in the study.

Data collection
A semi structured questionnaire with three sections was used to collect data. The first section constituted retrospective records review; where data was extracted regarding onset of illness after consumption of illicit brew, the clinical presentation of the patient, the provisional diagnosis that was made by the clinician, the type of laboratory investigations carried out and their results, the case management and the outcome. The next section was a key informant interview; where health providers particularly in charge of disaster preparedness and response or heads of health management teams were asked questions relating to disaster preparedness and response. The questions entailed outbreak detection methods and criteria, interventions made during the previous outbreak and assessment of existing emergency preparedness and response plans. Lastly, methanol case tracing; was conducted to interview survivors and proxies in situations where the case patients had died or migrated to a far location. The area public health officer, coupled with the chief and the community health workers (CHWs) were used to trace the households of the cases. Data was collected on alcohol consumption proceeding the incident, whether the victim became ill after consumption of the illicit brew, the quantity consumed and the type of brand that had been consumed.

Data analysis
Data was entered in preformed Epi Info version 7 make views daily. The resulting database was cleaned for inconsistencies then analysed. Descriptive analysis was done using count and summarized by proportions.

III. RESULTS

1.0 Descriptive epidemiology of the cases enrolled
A total of 278 cases were enrolled in the study during the investigation in the period between 28th May and 12th June 2014. A hundred and six (38%) of the cases were traced, these were distributed as follows: 15 (19%) in Kiambu, 49(54%) in Embu, 14(39%) in Makueni, 15(39%) in Kitui, 4(50%) in Nakuru and 9(41%) in Nyandarua County. Of the cases enrolled, males constituted 91% (n=253). The contributions of the counties was as follows: 90 (32%) were from Embu County, 77 (28%) Kiambu County, 38 (14%) Makueni County, 36 (13%) Kitui County and 22 (8%) were from Nyandarua County. The mean age of the enrolled cases was 37±12
Eighty-five (53%) were married, 52 (34%) single. A total of 68 deaths occurred among 256 cases whose outcome was verifiable making a case fatality rate of 27%. Majority of the deaths occurred in Embu (40%, n=36) and Kiambu (23%, n=18) counties. Majority deaths (26%, n=59) were males, the married constituted 28% (n=22) and single 36% (n=18) mortality. The highest number of deaths occurred in the age group 30-39 years (40%, n=104), the highest case fatality however, was among those aged 50 years and above (43%, n=17). Table 1

1.1. Epi curve of Methanol poisoning cases in various counties of Kenya, 2014

The Epi curves from different counties show single peaks except Kiambu County. Kiambu County may have had 2 sources of exposure, while others had a single source of exposure. The exposure occurred at different times in the Counties in the month of May 2014. The highest number of cases occurred on 5th May 2014. Figure 1-6

1.2 Clinical presentation of the cases enrolled

The cases presented mainly with abdominal pains (41%, n=105), visual loss (35%, n=91), headache (15%, n=39), nausea and vomiting (10%, n=25), drowsiness (9%, n=24) and general body weakness (9%, n=23). Table 2

2.0 Methanol poisoning case management

Two hundred and fifty six (92%) of the cases sought medical attention from various facilities in the respective counties. Medical care was sought in the following hospitals; Embu level 5 hospital (32%, n=90), Makueni County referral hospital (21%, n=57), Kiambu district hospital (13%, n=36), Tigoni hospital (12%, n=34), Naivasha district hospital (10%, n=27), Mutomo mission hospital (6%, n=17), Nazareth mission hospital (2%, n=6), Thika level 5 hospital (1%, n=3). Five (2%) of the cases had not been reported in any hospital.

A hundred and eighty-eight cases (71%) were diagnosed as alcohol intoxication and 62 (26%) as Methanol poisoning. Laboratory tests were performed for 31% (n=85) of the case patients. Table 3. Two hundred forty-two (87%) of the cases were admitted in hospital. Medical treatment differed in various health facilities. However, the main treatment provided across facilities constituted the following; intravenous fluids (75%, n=193), ethanol (53%, n=138), parabrinex i&ii (39%, n=100), omeprazole (38%, n=98), ranitidine (30%, n=76), folic acid (27%, n=68), antibiotic (14%, n=35), carbamazepine (9%, n=23), sodium bicarbonate (8%, n=20) and Paracetamol (6%, n=16). Other treatments constituted 18% (n=46). Sixty seven percent (n=164) recovered fully after treatment. Among those who did not achieve full recovery, 86% (n=68) died, 8% (n=6) became totally blind while 6% (n=5) developed partial blindness. Four percent (n=11) were referred to Kenyatta National Hospital for further management, 3% (n=8) abscended treatment while 1% (n=3) were transferred to another health facility. Table 4

3.0 Emergency preparedness and response

Twelve facilities were assessed for their preparedness towards emergencies and disaster, 4(33%) were health centers, 6(50%) district hospitals, while 2(17%) were regional referral hospitals. Six (50%) facilities had a disaster and emergency preparedness team. Eleven (92%) had experienced Methanol poisoning as their last disaster, where mainly (25%, n=3) the response was led by the medical superintendent. Information regarding the methanol poisoning event was first acquired through abnormal number of cases or deaths received at casualty (67%, n=8) followed by concerns from the community (58%, n=7), media (17%, n=2), laboratory (8%, n=1), and 8%(n=1) was detected through surveillance system. Other sources (42%, n=5) included presentation of the first cases at casualty, report by nurses on night duty, provincial administration and public health officers. Eleven facilities (92%) had used a criterion for line listing of cases, mainly the clinical presentation and linking of cases by brand consumed and the location. Two facilities (40%) sought laboratory confirmation from a private laboratory, 1(20%) from a reference laboratory, while others (40%, n=2) sought from the government chemist. Samples were mainly blood (60%, n=3), others included liquor and urine samples (40%, n=2). A laboratory report was obtained by 2(17%) facilities from a private laboratory.

A team coordinated the response in 10 (83%) of the facilities assessed. The team consisted mainly of medical superintendent, sub county medical officer of health, nursing officer in charge, disease surveillance coordinator, public health officer, provincial administration and the police. However, minutes were available in only 1(8%) facility. The main responses involved health education campaigns (67%, n=8), mobilization of emergency supplies (50%, n=6), coordination (42%, n=5), information campaigns and use of media (33%, n=4), provision of technical and resource support (25%, n=3), training on case management (17%, n=2), other measures (33%, n=4) included mainly quarantine of suspected brews.

An emergency preparedness plan was present in 2(17%) of the facilities assessed. The preparedness plan included all types of emergencies. Flow charts and protocols regarding management of methanol poisoning were observed in 2(17%) facilities. Linkage to rehabilitation services was reported in 6(50%) facilities. The services included ophthalmology (67%, n=4), counseling (17%, n=1) and psychiatry (17%, n=1). Availability of medicines for management of cases varied across facilities; i.e. fluids (83%, n=10), ethanol (58%, n=7), sodium bicarbonate (58%, n=7), folic acid (42%, n=5), other medications (33%, n=4) included parabrinexi&ii, vitamin b complex, ranitidine and omeprazole. It is important to note however, that intravenous ethanol (ethyl alcohol) was observed in only 1 facility (8%). The rest of the facilities administered oral ethanol purchased locally, mainly as Vodka or Ritchot brandy. Those unable to take oral medication were referred.

IV. DISCUSSION

This study shows that the Methanol poisoning event was of high magnitude similar to other events reported in Kenya (10)(11). The highest numbers of cases were observed in Embu County. This could have been due to delay in seeking care, the quantity of
adulterated beverages supplied to the County or the concentration of methanol contained in the brews. Late presentation contributes to severity and high number of deaths (5). The prognosis of methanol poisoning is dependent on the amount ingested and the subsequent degree of metabolic acidosis (2). Highest deaths occurred among male cases, the married and those aged 30-39 years. The highest case fatality rate was observed in the age group 50 years and above. Cases mainly presented with abdominal pain and loss of vision. Majority sought medical attention, where they were mainly diagnosed of alcohol intoxication. Treatment constituted mainly of intravenous fluids, ethanol, pabrinex i&ii and omeprazole. Preparedness and response to emergencies was fair across facilities. Information regarding the Methanol poisoning incident was first obtained through abnormal number of cases and deaths presenting at casualty and concerns from the community. Clinical presentation, linking of cases by alcohol brand consumed and location was the main criteria used for line listing of cases. The emergency teams mainly responded by conducting health education campaigns, mobilizing emergency supplies and coordinating the response. Emergency preparedness plans, flow charts and protocols regarding case management and intravenous ethanol (ethyl alcohol) were not readily available. Similarly, there were no clear linkages to rehabilitation services. This study was subject to some limitations. The study was conducted approximately three weeks after the event. The interviewed key informants, the victims and the proxies experienced difficulties recalling events accurately. Data extraction from health records faced the challenge of illegible data, missing files, missing vital data e.g. dates, diagnosis, treatment and difficulties in file retrieval. Case tracing was affected by fear of victim reprisal by police and provincial administration, migration of victims after the event, belief by victims and their relatives that the exercise would result to compensation leading to false declaration of cases, and difficult interviews where a family had lost a relative.

V. CONCLUSIONS
Methanol poisoning is a problem of public health concern in Kenya. Males are more affected, those married and those aged 30-39 years. Abdominal pain and loss of vision are important early warning signs of methanol poisoning, whereas unconsciousness or coma, breathlessness and hyperventilation are important danger signs. Those 50 years and above are particularly at risk. Examination by a clinician, hospital admission, proper diagnosis and treatment improves outcome. There are no guidelines, flow charts and protocols regarding case detection, diagnosis and management and linkages to rehabilitation services. Preparedness and response to disasters is fair across facilities.

VI. RECOMMENDATIONS AND PUBLIC HEALTH ACTIONS
We recommend the following: health education and behavior change communication in affected counties; technical support from the disaster preparedness unit during disasters and emergencies to mentor and improve capacity of counties during such events; establishment of guidelines, flow charts and protocols to harmonize case detection, diagnosis, management and rehabilitation of cases; establish or strengthen structures, functions and plans of emergency and response team and establishment of public health surveillance of methanol concentration in alcoholic drinks.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of cases</th>
<th>Number of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Embu</td>
<td>90 (32.37)</td>
<td>36 (40)</td>
</tr>
<tr>
<td>Kiambu</td>
<td>77 (27.70)</td>
<td>18 (23)</td>
</tr>
<tr>
<td>Kitui</td>
<td>38 (13.67)</td>
<td>5 (13)</td>
</tr>
<tr>
<td>Makueni</td>
<td>36 (12.95)</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Nyandarua</td>
<td>22 (7.91)</td>
<td>3 (14)</td>
</tr>
<tr>
<td>Nakuru</td>
<td>8 (2.88)</td>
<td>4 (50)</td>
</tr>
<tr>
<td>Nairobi</td>
<td>3 (1.08)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Unknown</td>
<td>2 (0.72)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Murang’a</td>
<td>1 (0.36)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Narok</td>
<td>1 (0.36)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>253 (91)</td>
<td>59 (26)</td>
</tr>
<tr>
<td>Female</td>
<td>25 (9)</td>
<td>9 (36)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>3 (1.15)</td>
<td>1 (33)</td>
</tr>
<tr>
<td>20-29</td>
<td>6 (26.05)</td>
<td>9 (15.79)</td>
</tr>
<tr>
<td>30-39</td>
<td>104 (39.85)</td>
<td>30 (30.61)</td>
</tr>
<tr>
<td>40-49</td>
<td>43 (16.48)</td>
<td>9 (21.43)</td>
</tr>
<tr>
<td>50+</td>
<td>43 (16.48)</td>
<td>17 (42.50)</td>
</tr>
<tr>
<td>Marital status</td>
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<td></td>
</tr>
<tr>
<td>Married</td>
<td>80 (52.98)</td>
<td>22 (28.21)</td>
</tr>
<tr>
<td>Single</td>
<td>52 (34.44)</td>
<td>18 (33.29)</td>
</tr>
<tr>
<td>Cohabiting</td>
<td>9 (5.96)</td>
<td>3 (33.33)</td>
</tr>
<tr>
<td>Divorced/separated</td>
<td>7 (4.64)</td>
<td>5 (71.43)</td>
</tr>
<tr>
<td>Widower</td>
<td>2 (1.32)</td>
<td>1 (50)</td>
</tr>
<tr>
<td>Widow</td>
<td>1 (0.66)</td>
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### TABLE 2: CLINICAL PRESENTATION OF METHANOL POISONING CASES IN VARIOUS COUNTIES OF KENYA,

<table>
<thead>
<tr>
<th>Clinical Presentation</th>
<th>N</th>
<th>%</th>
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<tbody>
<tr>
<td>Abdominal pain</td>
<td>105</td>
<td>40.7</td>
</tr>
<tr>
<td>Visual loss</td>
<td>91</td>
<td>35.27</td>
</tr>
<tr>
<td>Headache</td>
<td>39</td>
<td>15.12</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>25</td>
<td>9.73</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>24</td>
<td>9.3</td>
</tr>
<tr>
<td>General body weakness</td>
<td>23</td>
<td>8.91</td>
</tr>
<tr>
<td>Consumed suspected brew</td>
<td>19</td>
<td>7.4</td>
</tr>
<tr>
<td>Coma</td>
<td>17</td>
<td>6.59</td>
</tr>
<tr>
<td>Dizziness</td>
<td>12</td>
<td>4.65</td>
</tr>
<tr>
<td>Confusion</td>
<td>9</td>
<td>3.49</td>
</tr>
<tr>
<td>Movement disorders/unsteady gait</td>
<td>8</td>
<td>3.09</td>
</tr>
<tr>
<td>Dyspnea/hyperventilation</td>
<td>7</td>
<td>2.72</td>
</tr>
<tr>
<td>Cough</td>
<td>6</td>
<td>2.33</td>
</tr>
<tr>
<td>Loss of speech/hearing</td>
<td>5</td>
<td>1.95</td>
</tr>
<tr>
<td>Chest pain</td>
<td>5</td>
<td>1.95</td>
</tr>
<tr>
<td>Convulsions</td>
<td>4</td>
<td>1.55</td>
</tr>
<tr>
<td>Tremor/chills</td>
<td>4</td>
<td>1.55</td>
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<tr>
<td>Anorexia</td>
<td>3</td>
<td>1.17</td>
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Table 3: Management of methanol poisoning cases in various counties of Kenya, 2014

<table>
<thead>
<tr>
<th>Case management</th>
<th>n</th>
<th>%</th>
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<tr>
<td>Seeking medical attention</td>
<td>256</td>
<td>92</td>
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**Hospital visited**

<table>
<thead>
<tr>
<th>Hospital visited</th>
<th>n</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>Embu level 5</td>
<td>90</td>
<td>32.37</td>
</tr>
<tr>
<td>Tigoni hospital</td>
<td>34</td>
<td>12.23</td>
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<tr>
<td>Makueni CRH</td>
<td>57</td>
<td>20.50</td>
</tr>
<tr>
<td>Kiambu hospital</td>
<td>36</td>
<td>12.95</td>
</tr>
<tr>
<td>Nazareth hospital</td>
<td>6</td>
<td>2.16</td>
</tr>
<tr>
<td>Thika level 5</td>
<td>3</td>
<td>1.08</td>
</tr>
<tr>
<td>Naivasha district hospital</td>
<td>27</td>
<td>9.71</td>
</tr>
<tr>
<td>Narok County hospital</td>
<td>3</td>
<td>1.08</td>
</tr>
<tr>
<td>Mutomo mission hospital</td>
<td>17</td>
<td>6.12</td>
</tr>
</tbody>
</table>

**Hospital admission**

<table>
<thead>
<tr>
<th>Hospital admission</th>
<th>n</th>
<th>%</th>
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<tr>
<td>Embu level 5</td>
<td>86</td>
<td>96.56</td>
</tr>
<tr>
<td>Tigoni hospital</td>
<td>19</td>
<td>55.88</td>
</tr>
<tr>
<td>Makueni CRH</td>
<td>56</td>
<td>98.25</td>
</tr>
<tr>
<td>Kiambu hospital</td>
<td>36</td>
<td>100</td>
</tr>
<tr>
<td>Nazareth hospital</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>Thika level 5</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>Naivasha district hospital</td>
<td>22</td>
<td>81.48</td>
</tr>
<tr>
<td>Narok County hospital</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mutomo mission hospital</td>
<td>17</td>
<td>100</td>
</tr>
</tbody>
</table>

**Provisional diagnosis**

<table>
<thead>
<tr>
<th>Provisional diagnosis</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol intoxication</td>
<td>168</td>
<td>71</td>
</tr>
<tr>
<td>Methanol poisoning</td>
<td>62</td>
<td>26</td>
</tr>
<tr>
<td>Alcohol induced gastritis</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Alcohol withdrawal syndrome</td>
<td>1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Alcoholic coma</td>
<td>1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>1</td>
<td>&lt;1</td>
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</table>
Table 4: Treatment of Methanol poisoning cases in various counties of Kenya, 2014

<table>
<thead>
<tr>
<th>Treatment</th>
<th>n</th>
<th>%</th>
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</thead>
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<tr>
<td>I.V. fluids</td>
<td>193</td>
<td>74.52</td>
</tr>
<tr>
<td>Ethanol</td>
<td>138</td>
<td>53.28</td>
</tr>
<tr>
<td>Pabrinexi&amp;ii</td>
<td>100</td>
<td>38.91</td>
</tr>
<tr>
<td>Omeprazole</td>
<td>98</td>
<td>38.28</td>
</tr>
<tr>
<td>Ranitidine</td>
<td>76</td>
<td>29.69</td>
</tr>
<tr>
<td>Folic acid</td>
<td>68</td>
<td>26.56</td>
</tr>
<tr>
<td>Other treatment</td>
<td>46</td>
<td>17.97</td>
</tr>
<tr>
<td>Antibiotic</td>
<td>35</td>
<td>13.67</td>
</tr>
<tr>
<td>Carbamazepine</td>
<td>23</td>
<td>8.95</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>20</td>
<td>7.81</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>16</td>
<td>6.3</td>
</tr>
</tbody>
</table>
FIGURE 1: EPI CURVE OF METHANOL POISONING CASES IN EMBU COUNTY, KENYA, 2014
FIGURE 2: EPI CURVE OF METHANOL POISONING CASES IN MAKUENI COUNTY, KENYA, 2014
FIGURE 3: EPI CURVE OF METHANOL POISONING CASES IN NYANDARUA COUNTY, KENYA, 2014
FIGURE 4: EPI CURVE OF METHANOL POISONING CASES IN KITUI COUNTY, KENYA, 2014

Date of onset of illness

Number of cases

COUNT
FIGURE 5: EPI CURVE OF METHANOL POISONING CASES IN KIAMBU COUNTY, KENYA, 2014
Figure 6: Epi curve of Methanol poisoning cases in Nakuru County, Kenya, 2014
**ACKNOWLEDGMENT**

We would like to acknowledge the Ministry of health, Kenya, the management teams of the involved counties, the medical superintendents, sub-county medical officers of health, nursing officers in charge, disease surveillance coordinators, public health officers, health records and information officers, health care providers, the provincial administration and community health workers for their invaluable support during the exercise.

In addition, we would like to sincerely thank the FELTP faculty, the disaster preparedness and response unit and WHO, Kenya, for the mentorship and financial support in carrying out the investigation.
REFERENCES


AUTHORS

First Author – Author name, qualifications, associated institute (if any) and email address.
Second Author – Author name, qualifications, associated institute (if any) and email address.
Third Author – Author name, qualifications, associated institute (if any) and email address.

Correspondence Author – Author name, email address, alternate email address (if any), contact number.
Successful Gazprom in Serbia

Abdualla Mohamed Hamza

Abstract- Gazprom is a global energy company. Its major business lines are geological exploration, transportation, storage, processing, production and sales of gas, gas condensate and oil.

Russian holds the world’s largest reserves of natural gas (see fig. 1).

It alone produce 22% of the world’s gas, and in recent year has become the world’s top gas exporter, mainly to Europe.

In addition to the rich endowment of gas, the Russian state has followed strikingly different paths in the oil and gas industries since the breakup of the Soviet Union.

The Russian government followed a different strategy. It retained the largest stake in the Russian gas behemoth, Gazprom, and has been able to run the enterprise as a state-controlled firm.

Only when it was confident that the enterprise was under unequivocal control of the Kremlin was the Russian government willing to sell larger stakes—while retaining a controlling share—to private investors and favored companies in the west.

Gazprom is the richest company in Russia. In 2005 Gazprom alone accounted for 8% of Russia's GDP, and provided about 25% of its earnings to the federal budget.

Even before the new company acquisitions of 2005 and 2006, Gazprom had become the largest gas company in the world. It supplies most of the gas used by households and industry in Russia, as well as gas that generates around 50% of Russia’s electricity.

Long term contract (2012—2021) between Russian and Serbia was signed on October 13, 2012 allowed gas supply to be increased to 5 bcm per year.

New company was established under name of Naphtha Industrial Serbia (NIS) on October 1, 2005, where also underground store (UGS) was signed on January 25, 2008 its headquarters placed in Novi Sad by value of 450 mcm maximum daily withdrawal productivity of 5 mcm in Serbia, Hungary, Bosnia and Herzegovina.

51% of Nis's share were sold to Gazprom for (400 million euro) and (550 million euro) in investment until 2012.

Moreover the restricting plan aimed to transfer the sector into partial private sector when 20% of the remaining Nis’s shares were listed on the Belgrade Stock Exchange since 30 August 2010.

II. THE OBJECT OF THIS PAPER

The goal of this paper to introduce about meaning of Gazprom and its influence on local and world economies.

Cooperation in gas sector

On October 13, 2012, Russia and Serbia signed an Intergovernmental Agreement on natural gas supply in 2012-2021, allowing gas supply to be increased to 5 bcm per year.

Based on an Intergovernmental Agreement dated March 27, 2013, Gazprom Export and Yugorosgaz signed a long-term contract for natural gas supply to Serbia until the end of 2021.

As at January 1, 2015, a total of around 12.14 bcm of gas had been supplied under the contract with this company, including 1.36 bcm in 2014.1

For restructuring the sector a new company was established under name of Naphtha Industrial Serbia (NIS) on October 1, 2005, where also underground store (UGS) was signed on January 25, 2008 it's head quarter placed in Novi Sad by value of 450 mcm maximum daily withdrawal productivity of 5 mcm in Serbia, Hungary, Bosnia and Herzegovina.2

These investments include Serbian South stream gas pipeline project and the construction of (UGS) facility in BanatskiDvor.3

Moreover the restricting plan aimed to transfer the sector into partial private sector when 20% of the remaining Nis’s shares were listed on the Belgrade Stock Exchange since 30 August 2010.

2www.Gazprom export.com
3www.Serbia’s NIS to expand in four E. European states
III. EXPLORATION AND PRODUCTION

NIS is the only company in Serbia which deals with exploration and production of crude oil and natural gas, as well as with production of geothermal energy. The company disposes with all necessary equipment for the performance of a whole range of complex activities such as geophysical exploration, control of production of crude oil, gas and geothermal energy. The majority of NIS oil fields are located on the territory of Serbia, in the province of Vojvodina, but upstream has business operations both in Serbia and abroad. In 2011 NIS started to expand business in south-east Europe: in Bosnia and Herzegovina, Romania and Hungary.

Table 1. Russian Oil and Gas Export and Total Export Revenues

<table>
<thead>
<tr>
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Table 1. Russian Oil and Gas Export and Total Export Revenues.

Filling stations in Belgrade

NIS owns the largest network of filling stations in Serbia - 334 filling stations, 10 loading terminals, 18 liquefied petroleum gas (LPG) bottle shops, 44 warehouses, aviation fuel pumping facility at Belgrade Nikola Tesla Airport and a network of depots across Serbia. (LPG) retail includes all the regional sales centers in major cities in the country.

IV. MARKET AND FINANCIAL DATA

As of 2013, NIS posted a profit of approximately 48 billion RSD (€422 million) and 264 billion RSD (€2.31 billion) of revenues. It has 7,629 employees. As of 29 May 2015, NIS has a market capitalization.

As of 2013, Serbia paid $720 per 1,000 cubic meters of gas last year, which is significantly more than the average price other European countries, such as Germany, Austria, France and the Netherlands are paying. The average price of Russian gas to those countries last year was $574 for 1,000 cubic meters, almost one third lower than the price that Serbia is paying.5

Other countries in the Balkans, such as Croatia, Macedonia and Slovenia, are paying a lower price; only Bosnia and Herzegovina is paying more- $731 per 1,000 cubic meters.

The high price as related to the debt of more than a billion euros that Serbia owes to Gazprom.

In 2014 capital investments of NIS group reached 39.4 billion dinars, which is 29% less, while the value of direct and indirect taxes reached 136.2 billion dinars, which is 13% more than in 2013.

Measures to increase business efficiency and consistent implementation of the cost reduction program led to a positive effect of 8.3 billion dinars.

5www.belex.rs/eng.

Figure 1. Price in first half of 2012 ($ per thousand cubic meters).

V. FILING STATIONS IN BULGARIA

Gazprom Net’s subsidiary – Serbian has opened its first GAZPROM branded filling station in Bulgaria.6

The Bulgarian market has been identified as a priority market to develop the retail network under Gazprom brand in the region. NIS is currently completing the construction of 9 more filling stations, with an additional 10 stations also planned to further develop Gazprom branded retail network. By the end of the year there will be a total of over 40 stations in Bulgaria. NIS now operates Gazprom branded filling stations in three countries in Balkan region following the opening of gas stations in Serbia and Romania at the end of 2012.

The Gazprom branded network will have over 250 filling stations operating in the Balkan region by the end of 2015, with 80 of these in Bulgaria. NIS will manage the retail network.

The Gazprom branded premium filling stations offer clients the latest euro standard fuels – diesel, gasoline, LPG and lubricants. Filling stations will include a shop, a restaurant and a café. Customers will also be able to use other services such as free wireless internet. 7

Launching a retail network under the Gazprom brand in Bulgaria is the next step towards achieving their strategic objective to develop a sales network in Europe.

Cooperation in gas sector in Bulgaria

On November 15, the Bulgarian state-owned gas distributor Bulgargaz signed a ten-year contract with Russian Gazprom regarding the annual purchase of 2.9 billion m3 of gas. The contract will come into force at the beginning of 2013. Bulgaria’s Prime Minister Boyko Borisov announced that they include a 20% decrease in gas prices and the withdrawal from existing services provided by the two intermediaries: Russian-Bulgarian Overgas (ownership: 50% Gazprom, 50% Overages Holding) and Russian-German Wee (ownership: 50% Gazprom, 50% Winter shall). According to Bulgaria, the contract also includes more flexible terms and conditions regarding supplies: the ability to renegotiate the contract after six years following its establishment and a more favorable ‘take or pay’ clause (the level of compulsory payment has been set at 80% of the contracted volume of gas - currently standing at 90%).

At the same time, on the day the contract was signed, the Russian-Bulgarian company South Stream Bulgaria (ownership: 50% Gazprom, 50% Bulgarian Energy Holding) issued a final investment decision regarding the construction of the Bulgarian section of the South Stream gas pipeline which will carry Russian gas to Europe. Similar decisions were issued last month.

by the companies responsible for the construction of particular sections: the submarine section and the section through the territories of Serbia, Hungary and Slovenia.

The information on the terms and conditions of the contract revealed in the press indicates that it has been a success for Bulgaria in terms of negotiations. It succeeded in securing one of its main demands: bypassing companies which act as supply intermediaries and at the same time Bulgaria likely obtained one of the highest price discounts among European customers of Gazprom. According to unofficial information, the price has been reduced from US$ 524 to US$ 420 for 1000 m3. This success was due to the very strong negotiating position of Bulgaria, which used its geographical position in order to demand preferential conditions in the gas contract in exchange for approval of south stream pipeline’s construction.

VI. CONCLUSION

In August 1989, the Ministry of Gas Industry was reconfigured as State Gas Concern Gazprom, which became the country’s first state corporate enterprise.

A Russian-Serbian Intergovernmental Agreement was signed on February 7, 1995. To strengthen Gazprom’s position in the region, a new Russian-Serbian joint venture, Yugorosgaz (50% Gazprom-owned), was established in July 1996 under an Intergovernmental Agreement dated April 11, 1996.

Srbijagas, established on October 1, 2005 by the government of the Republic of Serbia in the course of restructuring the state-owned enterprise Naphtha Industrial Srbije (NIS).

NIS is the only company in Serbia which deals with exploration and production of crude oil and natural gas. Gazprom purchased 51% of Nis’s shares for (400 million euro) and (550 million euro) in investment until 2012 on 25 January 2008.

NIS owns the largest network of filling stations in Serbia - 334 filling stations, 10 loading terminals, 18 LPG bottle shops, 44 warehouses.

In 2013 NIS posted a profit of approximately 48 billion RSD (€422 million) and 264 billion RSD (€2.31 billion) of revenues.

Serbia paid $720 per 1,000 cubic meters of gas, which is significantly more than the average price other European countries, such as Germany, Austria, France and the Netherlands are paying. The average price of Russian gas to those countries was $574 for 1,000 cubic meters, almost one third lower than the price that Serbia is paying.

Gazprom Neft’s subsidiary – Serbian has opened its first GAZPROM branded filling station in Bulgaria.

NIS is currently completing the construction of 9 more filling stations, with an additional 10 stations also planned to further develop Gazprom branded retail network.

Bulgaria signed a ten-year contract with Russian Gazprom regarding the annual purchase of 2.9 billion m3 of gas.

REFERENCES


AUTHORS

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Electronic Business

Abdualla Mohamed Hamza

Faculty of Business and Law “Union Nikola Tesla” University, Knez Mihaljeva 33, Belgrade, Serbia

Abstract- Electronic Business or e-business is a term which can be used for any kind of business or commercial transaction that includes sharing information across the internet. Commerce constitutes the exchange of products and services between businesses, groups and individuals and can be seen as one of the essential activities of any business. Electronic commerce focuses on the use of information and communication technology to enable the external activities and relationships of the business with individuals, groups and other businesses or e business refers to business with help of internet. The goal of this paper is to introduce meaning of electronic business and deferent between electronic and commerce business

Index Terms- internet, commerce business, economy, information

I. INTRODUCTION

In the emerging global economy, e-commerce and e-business have increasingly become a necessary component of business strategy and a strong catalyst for economic development. The integration of information and communications technology (ICT) in business has revolutionized relationships within organizations and those between and among organizations and individuals. Specifically, the use of ICT in business has enhanced productivity, encouraged greater customer participation, and enabled mass customization, besides reducing costs. With developments in the Internet and Web-based technologies, distinctions between traditional markets and the global electronic marketplace—such as business capital size, among others—are gradually being narrowed down. The name of the game is strategic positioning, the ability of a company to determine emerging opportunities and utilize the necessary human capital skills (such as intellectual resources) to make the most of these opportunities through an e-business strategy that is simple, workable and practicable within the context of a global information milieu and new economic environment. With its effect of leveling the playing field, e-commerce coupled with the appropriate strategy and policy approach enables small and medium scale enterprises to compete with large and capital-rich businesses. On another plane, developing countries are given increased access to the global marketplace, where they compete with and complement the more developed economies. Most, if not all, developing countries are already participating in e-commerce, either as sellers or buyers. However, to facilitate e-commerce growth in these countries, the relatively underdeveloped information infrastructure must be improved.

II. DEFINING OF E-BUSINESS AND E-COMMERCE

Electronic business (e-business) can be defined as the use of the internet to network and empower business processes, electronic commerce, organizational communication and collaboration within a company and with its customers, suppliers, and other stakeholders. E-businesses utilize the internet, intranets, extranets and other networks to support their commercial processes. Electronic commerce (e-commerce) is the buying and selling, marketing and servicing of products and services via computer networks. Since e-business includes the process of transacting with suppliers and customers there is an overlap in activities with e-commerce. Although the terms ‘e-business’ and ‘e-commerce’ are often used synonymously, the distinction between them lies in the broader range of processes in e-business that incorporates internal transactions within an organization. These include transactions relating to procurement, logistics, supply chain management, payments, stock control and order tracking. E-commerce can best be conceived as a subset of e-business. Where the two concepts overlap is in the buying and selling of products and services. Buy-side e-commerce refers to electronic transactions between a purchasing organization and its suppliers and sell-side e-commerce refers to electronic transactions between a supplier organization and its customers. Tab 1 illustrates the relationship between e-business and e-commerce.

Tab 1. The relationship between e-business and e-commerce

<table>
<thead>
<tr>
<th>Electronic business</th>
<th>Electronic commerce</th>
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<tbody>
<tr>
<td>Buying and selling electronically</td>
<td>Sell-side e-commerce</td>
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<tr>
<td>Sell-side e-commerce</td>
<td>Buy-side e-commerce</td>
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<tr>
<td>Electronic distribution</td>
<td>Online customer service</td>
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<td>Electronic marketing</td>
<td>Secure transactions</td>
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<tr>
<td>Automation of processes</td>
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III. IS E-COMMERCE THE SAME AS E-BUSINESS?

While some use e-commerce and e-business interchangeably, they are distinct concepts. In e-commerce, information and communications technology (ICT) is used in inter-business or inter-organizational transactions (transactions between and among firms/organizations) and in business-to-consumer transactions (transactions between firms/organizations and individuals). In e-business, on the other hand, ICT is used to enhance one’s business. It includes any process that a business organization (either a for-profit, governmental or non-profit entity) conducts over a computer-mediated network. A more comprehensive definition of e-business is: “The transformation of an organization’s processes to deliver additional customer value through the application of technologies, philosophies and computing paradigm of the new economy.”

IV. THREE PRIMARY PROCESSES ARE ENHANCED IN E-BUSINESS

1. Production processes, which include procurement, ordering and replenishment of stocks; processing of payments; electronic links with suppliers; and production control processes, among others. 2. Customer-focused processes, which include promotional and marketing efforts, selling over the Internet, processing of customers’ purchase orders and payments, and customer support, among others; 3. Internal management processes, which include employee services, training, internal information-sharing, video-conferencing, and recruiting. Electronic applications enhance information flow between production and sales forces to improve sales force productivity. Workgroup communications and electronic publishing of internal business information are likewise made more efficient.

V. THE GROWTH OF E-BUSINESS

The most significant factor that transformed the internet into a global communications phenomenon was the development of the World Wide Web (WWW) in the early 1990s. This extended the functionality of the internet by introducing hypertext that linked documents held on the internet servers. This facilitated access to particular parts of documents or even to other relevant documents held on other servers. This was called the hypertext transfer protocol (HTTP) and derived from a markup language called hypertext markup language (HTML). Within the servers, each document, or pages within documents, is given a unique address. The addresses are termed universal resource locator (URL’s). The ability to access pages, documents and servers from many different websites created a network of interconnectivity and gave rise to the term the World Wide Web. The Web was the catalyst for huge changes in the business environment as more and more firms sought to integrate their traditional business models with those online. By the mid-1990s firms ‘born on the net’ emerged, whose function was to exploit the opportunities in the marketplace by using the internet? However, the key driver of the phenomenal rise of the internet was the rapid increase in the use of computers with access to the Internet and the Web by the public. From 1993 to 1996 the number of computer users with access to the internet and the Web rose from zero to 10 million. In 2004 the figure stood at around half a billion. Also, the number of websites appearing on the Web has increased exponentially from 1993 onwards. In the months following the release of HTTP and HTML there was less than 50 websites in existence. By the end of the decade there were countless millions available. Since the commercialization of the internet in the mid-1990s demand for its use has increased hugely each year. In fact, the growth of the Internet has been such that there are fears that the existing infrastructure may be unable to sustain demand into the future. The Internet has had a profound effect at so many different levels including individuals, society, business, governments, education, health, security services, entertainment, news services, financial markets and many others. To comprehend the staggering growth of the internet many analysts turn to the prediction of the founder of Intel and inventor of the chip, Gordon Moore. In the mid-1960s Moore predicted that the number of components that could be located on a single chip would double every twenty-four months. In the twenty years between 1974 and 1994 the Intel 8080 chip increased the number of transistors from 5000 to over 5 million. This exponential growth phenomenon became known as Moore’s law and can easily be related to the growth witnessed in demand for access to information technology in general, and the internet in particular. The Internet has created a new communications channel and provides an ideal medium for bringing people together cheaply efficiently and for a wide range of different reasons. It has also presented opportunities and challenges for the business community. As consumers become more knowledgeable about using the Internet to service their needs and wants so the business community has been boosted by the potential the Internet presents for extending markets, developing new products and services and achieving a competitive advantage and profitability. New markets quickly emerged based on applications of the Internet, most prominently the business-to-consumer (B2C) and business-to-business (B2B) sectors. One of the key characteristics of e-commerce is the ease of entry for firms. The cost of entry and exit is low relative to traditional industries, as firms do not require large sales teams, costly investment in infrastructure or high sunk costs in order to compete effectively. Rising connectivity rates among potential customers ensures increasing competition among e-commerce firms as more are attracted to the source of potential revenue. Importantly, the Internet does away with geographical boundaries thereby increasing yet further the extent of competitive rivalry. Intense competition is a characteristic of the internet economy and has spread across all e-business and e-commerce sectors.

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3 Ravi, K., (1997) electronic commerce (University of Rochester, New York)
2 outlines the main benefits that firms and consumers gain from using the internet.4

<table>
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<td>3</td>
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<td>Improved logistics</td>
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<td>Automated processes</td>
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<td>2</td>
<td>Ease of use</td>
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<td>One-to-one customer service</td>
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<td>10</td>
<td>Access to internet community</td>
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<tr>
<td>11</td>
<td>Empowerment</td>
</tr>
</tbody>
</table>

Source: e-business book

VI. THE TOP TEN REASONS TO INVEST IN E-BUSINESS?

✓ You can’t afford not to. The costs of not doing e-business include loss of customers to competitors with good websites and loss of potential revenue. There are also existing tools and software, many designed for small businesses that offer you low-cost solutions to meet your business needs.

✓ It can help you find better business deals. You can use the Internet to find information about products, services and suppliers. It provides you with quick access to product reviews and cost comparisons.

✓ It can increase your sales. A website can increase your sales by providing a larger market, by making it easier for customers and suppliers to look at your products and services, and by making it easier for people to buy your products.

✓ It enables you to improve your marketing strategies. With the Internet, it’s easier to summarize and analyze information about customers visiting and buying from your website. You can use this information to modify your promotional strategies to maximize sales.

✓ It can help you reach new markets. People are increasingly using the Internet to find information and to conduct transactions. Depending on your goals, the Internet can help you target new customers, including customers beyond your local market. Even if you don’t sell anything online, a website makes it easier for potential customers to find you.

✓ It enhances customer service. The Internet allows you to give customers more choices while offering them quick and easy access to information about your business. E-mail and Frequently Asked Questions (FAQs) are two examples of simple, cost-effective tools that can improve your customer relations. Plus, the Internet allows you to service clients.

✓ It enables quick and widespread distribution of information. By using a website that can be easily updated, you will be able to quickly supply customers with current information. For example, you can change your products and prices more quickly and efficiently on the Web compared to a print-based catalogue.

✓ It allows small businesses to compete with larger businesses. From the vantage point of the customer, a professional web presence can make your business comparable to larger competitors and enhance the credibility of your business.

✓ It can reduce costs. E-business can reduce costs by decreasing the time it takes to complete business processes. Invoices can be processed quickly and accurately. Studies show that an automated system can save two thirds of the costs involved in manually processing a customer order.

✓ It can make business processes more efficient. It can help improve the speed and accuracy of transactions. For example, an online ordering system can eliminate or reduce manual paper work and telephone order taking.5

VII. USE OF THE INTERNET

Demand for internet services has been growing year on year since it became generally available to the public in the mid-1990s. The internet has had an impact on the economic and social fabric of many societies and has been the catalyst for changes in the way people interact, do business, gain information and seek entertainment. The internet has provided a whole new economy with its own rules and terms of engagement. Businesses and customers have been through a period of learning about how they can best leverage advantage from using the internet and many users are now adept at utilizing the technology in a versatile and effective way to enhance their lifestyle. In the UK around 60% of adults actively use the internet (Oxus). Of those, seven out of ten regard the internet as important or very important to their lives. The average time spent on computers by the 2200 people surveyed by the Oxford Internet Institute (OII) in 2005 was one and a half hours. The time spent using the internet has been at the expense of other activities such as reading, watching television and family life. There are many types of activities available on the internet but searching for information or communicating via e-mail are the two most

4Debbie, and Rechard (2006) introduction to e-business handbook


www.ijsrp.org
popular. Not everyone enjoys the benefits of the internet. There is, in each country, a section of society that remains marginalized or excluded from the digital revolution.6

VIII. BENEFITS OF E-BUSINESS:7

- Generate additional Revenues
- New markets
- New products
- New customers
- Reduce Costs (Integration and ‘Collaboration’)
- Process efficiency
- Reduce IT variety and –complexity
- Customer Retention (‘Added Services’ and ‘Virtual Community’)
- Know more about your customers
- Integrated channel management
- Proactive and personalized offerings
- Improve Image / Position Brand
- Applying innovative technologies
- Leadership enterprise

IX. CONCLUSION

E-business and e-commerce are technology-driven industries. The development of the internet and its commercialization through the World Wide Web has opened up an important channel of communication between buyers, sellers and partners in the supply chain of products and services. The huge growth in internet usage has only been possible because of the information infrastructure that supports such a large amount of information traffic. There are concerns that if internet usage continues to grow at levels seen during the last decade, then further infrastructure development will be required to support the demand. However, the introduction of broadband technology has helped alleviate congestion on the internet by accommodating greater numbers of users as well as offering high-speed services. The e-business environment offers a number of opportunities for firms to present unique value propositions to customers. The e-business industry structure has been through three distinct phases. Firstly, there was a surge of interest from internet start-ups leading to the so-called dot-com era. There followed an industry ‘shake-out’ as the forces of supply and demand meant that many firms were unable to achieve economic viability. Only those with robust business models were able to survive and prosper. The current industry structure is characterized by an increasing number of entrants seeking a market share in all the e-business markets. However, unlike in the late 1990s, the demand for products and services online has been rising rapidly as consumers become increasingly aware of the benefits that the internet can provide.


7 Chetan, K,. (1999) Ramaiah School of Advanced Studies - Bangalore

REFERENCES


AUTHORS

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Effect of Two Different Movement Patterns of Isotonic Muscle Work on Fatigue Index, Power, Strength and Endurance of Lower Limb

Vashi Payal¹, M.Vijayakumar², Lakshmi pavani P.³, Ghare Shuua⁴

Physiotherapy, Dr.D.Y.Patil Vidyapeeth, Pune

Abstract- Background: Traditional exercise protocol emphasis towards terminal range of motion. This typically consists of a large braking phase. This occurs because of the ‘sticking region’ of microsecond while exchange from eccentric load to concentric and vice-versa. Activities of daily living did not include abrupt full range of motion. There is smooth and continuous change in muscle length. This mechanism of direct exchange without breaking down was ignored during fitness trainings. Aim: To update traditional isotonic exercise pattern and improve performance of fitness training of lower extremity by discovering the effect of full range abrupt movement training and near to full range, sinusoidal movement. Method: Untrained males and females (n=51) as per homogeneous inclusion criteria were selected for study. Participants randomly separated into groups. Group-A (n=22) had performed Full range abrupt movement with resting period of micro second and group-B (n=22) was asked to perform nearly full range, sinusoidal movement on metronome rhythm to maintain small difference of amplitude and velocity between two groups. Both the groups had perform progressive resisted exercises on Mcqueen’s training protocol for 4 weeks. The outcome measures for Pre and post assessment were Squat Test (ST) for strength, Fatigue Index (FI) to measure power and fatigue level and Beep Test (BT) to decide endurance level. Results: Inferential statistical analysis showed significant difference in strength and endurance level in both the groups between pre and post training values (p=<0.001) with in group. Fatigue index which shows level of fatigue and power was insignificant (p=>0.001) for both the groups. Comparison of both the groups didn’t indicate any statistical significant difference between two groups but clinical significance showed that nearly full range, sinusoidal movement (ST-14.49%, BT-7.94%,FI-12.16%) will be more beneficial than full range abrupt movement (ST-8.03%, BT-7.33%, FI-2.12%). Conclusion: The inclusion of near to full range sinusoidal training pattern will not provide any improvement in fitness status in comparison with full range abrupt training pattern. Both the method of training appears to be an equally beneficial.

Index Terms- Abrupt movement, Endurance, Fatigue index, Near to full range movement, Strength

1. INTRODUCTION

Activities of daily living, it is very evident that they require relatively small percentage of their full active range of motion. However traditional resistance training is focused to increase strength and power with movement patterns concentrated on the terminal range of movement.¹

Many activities of daily living demand a greater range of motion but maximum mechanical advantage of muscle is seen in middle range activities as more force is produced by mid range muscle work.² This is because full ROM exercises typically consist of a large braking phase/deceleration phase. This large deceleration phase occurs because of the ‘sticking region’, i.e. switch from eccentric load braking to concentric force.

Studies done by (Ross Clark et. al, 2011)¹ on the influence of variable range of motion training on neuromuscular performance and control of external loads and found that Various ROM training improves terminal and midrange performance gains, resulting in the athlete possessing an improved ability to control external loading and produce dynamic force for upper limb. Mookerjee S. et al 1999³ mentioned that the comparison of strength differences and joint action durations between full and partial range-of-motion bench press exercise suggested that dynamic partial range of motion training is an advanced strength-training technique frequently utilized by athletes in many sports. But as per our knowledge, there was no study which focused on mechanisms of the exchange from eccentric load braking to concentric force for lower limb.

Figure: 1 Full range abrupt movement

<table>
<thead>
<tr>
<th>End Range</th>
<th>Initial Range</th>
<th>Muscle work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eccentric muscle work</td>
<td>Concentric muscle work</td>
<td>Resting Period (micro second)</td>
</tr>
</tbody>
</table>

Figure: 2 Near to full range, sinusoidal movement

[Image of diagram showing End Range, Initial Range, Muscle work with Eccentric Muscle work, Concentric Muscle work, and Transformation of Muscle work]
In resistance exercise, the mechanisms of the exchange from eccentric load braking to concentric are being ignored. This may reduce the effect of strength adaptations from resistance exercise because a countermovement is required in the midrange of the movement or near to full range of movement, resulting in a suboptimal ability to control external loading in this region and a resulting in increased risk of injury. To overcome these limitations, a resistance training program that requires near-maximal countermovement performance.

We hypothesized that there will be no difference in the fitness status following 4 weeks of training program of two types of isotonic movement pattern (Hypothesis H0). Because both movement pattern involve same frequency and duration. Small difference of amplitude and velocity, so there is less possibility of difference and there will be difference in the fitness status following 4 weeks of training program (Hypothesis H1) although both muscle works involve same Intensity, volume, duration and similar muscle work, the pattern of work will be different. To update traditional isotonic exercise pattern and improve performance of fitness training of lower extremity by discovering the effect of full range abrupt movement training and near to full range sinusoidal training.

### 2. MATERIAL AND METHOD

51 participants with age between 20 to 24 years, Height among 145 to 165 cm, weight between 50 to 70 kg were taken. Deep squat test and leg press test were performed as a primary screening. Participants with any history of severe muscular-skeletal, cardio-respiratory or neurological disorders before or during 1 year which required immobilization or hospitalization for more than 72 hours and Individual who is instructed to avoid strenuous physical activity were excluded.

Ethical clearance was obtained from ethical committee. Written consent was obtained after explaining the procedure to the subjects. 44 participants were pre assessed by Squat Test (ST) for strength, Fatigue Index (FI) to measure power and fatigue level and Beep Test (BT).

As per Mcqueen exercise protocol of progressive Resisted exercise program of 4 week (i.e.3 alternate days/week) were explained to all subjects. Training protocol for first two weeks was decided by evaluating 10RM. Initiation of training protocol is based on 70-80% of 10RM. For open chain exercise training, elastic band color equivalent to 70-80% of 10RM was decided. Training protocol for both the groups involve 10 repetitions with 70% to 80% of 10RM weight with 3 minutes of rest in between each exercise. One of the close chain exercise was leg press performed on leg press machine and another close chain exercise was deep squat. Deep squats were performed with different weights of dumbbells as per individual’s difference of 10RM. Open chain exercise protocol includes quadriceps and hamstring training. These exercises were done by pre decided elastic band, color equivalent to 70-80% of 10RM. Angle of pull for all the participants were same. Group A performed full range abrupt movement with microsecond hold from eccentric to concentric transfer and vice-versa and Group B performed nearly full range, sinusoidal movements without hold for microseconds during transfer of eccentric to concentric and vice-versa on rhythmic manner with metronome.

After completion of two weeks 10RM were evaluated to decide progression of their protocol. Same training protocol was continued for next two weeks with increased or same amount of weight. To identify the effectiveness of two different exercise protocols, strength, endurance and fatigue index were checked again after 4 week. 3 participants from group-A and 1 from group-B were terminated from study. 3 participants from group-A and 4 participants from group-B were willingly dropped out of study because of inconvenience with training timings and training protocol.

### 3. DATA ANALYSIS AND RESULTS

Descriptive and Inferential statistical analysis were comprehended by non-parametric Wilcoxon Signed Rank test within the group and comparisons between the groups for Post training were done using the Mann-Whitney U test.

A significant change between pre-testing session and post testing session were obtained for strength and endurance within same group after training of 4 weeks. (Table: 1,2) Fatigue index shows the level of fatigue and results for power, which needs to be decrease for positive training effects, but it increased in both the groups (Table: 3).

<table>
<thead>
<tr>
<th>Table: 1 Pre and Post training values of Squat test:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group</strong></td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

[www.ijsrp.org](http://www.ijsrp.org)
Table: 2 Pre and Post training values of Beep test:

<table>
<thead>
<tr>
<th>Group</th>
<th>M(SD)</th>
<th>p value</th>
<th>Clinical difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>24.44(5.93)</td>
<td>&lt;0.001</td>
<td>7.33%</td>
</tr>
<tr>
<td></td>
<td>26.3(6.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>22.01(2.69)</td>
<td>&lt;0.001</td>
<td>7.94%</td>
</tr>
<tr>
<td></td>
<td>23.83(8.79)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Graph: 1 shows means of Group-A and Group-B increased significantly in pre to post training values of Squat test.

Table: 3 Pre and Post training values of Fatigue Index:

<table>
<thead>
<tr>
<th>Group</th>
<th>M(SD)</th>
<th>p value</th>
<th>Clinical difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.75(2.38)</td>
<td>&gt;0.001</td>
<td>7.69%</td>
</tr>
<tr>
<td></td>
<td>2.97(2.33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>2.34(2.18)</td>
<td>&gt;0.001</td>
<td>1.69%</td>
</tr>
<tr>
<td></td>
<td>2.38(1.93)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Graph: 3 shows means of Group-A and Group-B increased which needs to be decrease and even there is no significant changed from pre to post training values of Fatigue Index.

Table: 4 Comparison of post training difference of group-A and Group-B

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Group-A</th>
<th>Group-B</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squat</td>
<td>5.3</td>
<td>8.8</td>
<td>&gt;0.001</td>
</tr>
<tr>
<td>Beep</td>
<td>1.86</td>
<td>1.81</td>
<td>&gt;0.001</td>
</tr>
<tr>
<td>Fatigue</td>
<td>0.22</td>
<td>0.05</td>
<td>&gt;0.001</td>
</tr>
</tbody>
</table>

Comparison of both the groups didn’t indicate any statistical significant difference between two groups but clinical significance showed that nearly full range, sinusoidal movement (ST-14.49%, BT-7.94%, FI-12.16%) will be more beneficial than full range abrupt movement (ST-8.03%, BT-7.33%, FI-2.12%).

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4. DISCUSSION

These strength improvements within the group may have occurred due to motor learning and coordination. As it is believed that strength gain is a combination of factors such as volition, motor neuron activity, and the coordinated activation of the supporting musculature.

As there was no difference in the fitness status following 4 weeks of training program of two types of isotonic movement pattern. The apparent reason for this is that, when fatigue level and power of both the groups were compared with its pre and post data using the Fatigue Index, minimal changes were observed. As per our anticipation, in both the groups, fatigue level was expected to increase, rather than decrease. But the reverse happened i.e. the lactate threshold had decreased as seen in the Fatigue Index as there was no anaerobic training protocol given to the subjects. This supports the theory that anaerobic training will only lead to an adaptation of increase in the capacity for generating high level of blood lactate i.e. increase the Lactate Threshold and improve pain tolerance to fatiguing exercise.

The muscle works in the activities performed in both the patterns of movement involve same intensity, volume, duration and similar muscle groups with only change in the pattern of movement caused by the differences in the level of contraction of muscle fibers. The resting period of a microsecond between eccentric and concentric work is seen in the full Range of movement performed by Group A whereas, there is a transfer of muscle contraction from concentric form to eccentric form and vice-versa in the work performed by Group B. However, as per literature, in near to full range sinusoidal movement, the

5. CONCLUSIONS

The inclusion of near to full range sinusoidal training pattern will not provide any improvement in fitness status in comparison with full range abrupt training pattern. Both the

6. ACKNOWLEDGMENT

I am highly indebted to my guide Dr.M.Vijayakumar (PT), and a teacher for his cordial support, valuable information, constant supervision and guidance. Without their co-operation this study method of training appears to be an equally beneficial component of training. However, both training pattern involve same frequency and duration some small difference of amplitude and velocity didn’t indicate enhance large difference.

I cannot be possible. I am sincerely thankful and grateful to Dr. Tushar J. Palekar, Ph.D. for giving me opportunity to carry out my dissertation in Dr.D.Y.Patil Vidyapeeth, Pune
REFERENCES


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APPENDIX

EXERCISE PROTOCOL

MacQueen exercise protocol

Progressive Resisted Exercise program: 4 week (i.e.3 alternate days/week) for both the groups.

Training protocol: 10 repetitions with 70% to 80% of 10RM weight following exercises with 3 minutes of rest in between each exercise.

- Close chain exercise: leg press and deep squatting.
- Open chain exercise: quadriceps and hamstring training.

Pre-evaluation to decide protocol [1/2 week]: Evaluation of 10RM for all the exercise.

Elastic band colour equivalent to 70-80% of 10RM for open chain exercise was decided.

Difference between two groups exercise performance:

- Group: 1 Full range abrupt movement - There is resting period of micro second from eccentric to concentric change and vice-versa.
- Group: 2 nearly full range, sinusoidal movement - No resting period of micro second from eccentric to concentric change and vice-versa.

Participants follow metronome rhythm to maintain same amplitude and velocity of exercise.

Re-evaluation to decide protocol [3/4 week]: After completion of two weeks 10RM were evaluated again for all the participants, to decide progression of their protocol.

Progression: Same training protocol was continued for next two weeks with increased or same amount of weight. (Depend upon progression of their 10RM).
Epidemiology of Wheat Rhizoctonia

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Abstract- Rhizioniasolani [Thanatephorus cucumeris] is a soil-borne pathogen occurs worldwide which causes economically important diseases to variety of vegetable and field crops, cereals especially wheat, ornamentals, and fruit and forest trees. The inflicted yield losses caused by this pathogen reaches up to 20% yearly worldwide on wheat crops. Environmental factors such as cool temperatures, wetter soils, and high humidity, planting date, winter temperatures, and disease levels in the previous wheat crop has been recorded to influence the occurrence on the field (Meyer, 2002). The objectives of this article is to present an overview of the epidemiology of Rhizonia on wheat.

Index Terms- Rhizoctonia, Epidemiology, Winter wheat, plant disease

I. INTRODUCTION

Winter wheat (Triticum aestivum) is an important staple grain crop found in cool and temperate countries. It acts as a food source for humans. It is usually planted in the autumn to germinate and develop into young plants and resume growth in early spring (Zołtańska, 2005). Wheat production is usually affected by some fungal pathogens (González Garcia et al., 2006). Among these pathogens is Rhizoctonia spp. causing various diseases affecting wheat production (Hamada et al., 2011). In previously published literature, two anamorph species of Rhizoctonia which causes disease on wheat production are widely recognised and studied. These include Rhizioniasolani and Rhizoctoniacerealis which are common pathogens affecting various crops especially wheat (Sneh et al., 1991).

R. solani [Thanatephorus cucumeris] is a soil-borne pathogen occurs worldwide which causes economically important diseases to variety of vegetable and field crops, cereals especially wheat, ornamentals, and fruit and forest trees. R. cerealis van der Hoeven (teleomorph: Ceratobasidium cerealeIDL Murray and LL Burpee) is a stem-base disease such as sharp eyespot on wheat and are present in temperate growing regions. The inflicted yield losses caused by this pathogen is averaged up to 20% yearly worldwide on wheat crops (Shu et al., 2014). Although the severity of this disease caused by Rhizoctonia pathogen on wheat varies from year to year between regions under different environmental conditions at their time of planting (Zhang and Dernoeden, 1997). The objectives of this article is to present an overview of the epidemiology of Rhizonia on wheat.

II. THE FUNGUS – RHIZOCTONIA

2.1 History and Taxonomy

The fungus, Rhizoctonia was first described by Julius Kuhn who observed a fungus on diseased potato tubers and named it Rhizioniasolani in 1858 (Ogoshi, 1996, Sneh et al., 1991). This earlier work done by Kuhn in 1858 on epidemiology of diseases caused by R. solani has been reviewed by Baker and Martinson (1970). Rhizoctonia spp. (phylum: Basidiomycota, class: Basidiomycetes, genera: Thanatephorus, Waitea, Koleroga, Ceratobasidium, Ulatobasidium, Athelia and Botryobasidium) is one of the most important destructive soil-borne disease to most agriculturally important plant such as wheat (Triticum aestivum) (Ogoshi, 1987, Ogoshi, 1996).

Rhizoctonia species are widely studied, particularly Rhizioniasolani and Rhizoctoniacerealis (Burpee et al., 1980; Budgea et al., 2009). R. solani occurs as a necrotrphic parasite which causes damping-off, root rot and stem based disease on numerous host plant species and alsoexist as thread-like growth on plants or in culture media (Figure 1) (Lewis and Lumsden, 2001). R. cerealis acts as causal agent of sharp eyespot disease. Areport by Hamada et al. (2011) suggested that the spread of disease caused by R. cerealis could be as a result of climate change, their means of dispersal, sclerotia formation, and environmental conditions that are favorable for the disease to grow (Robertse et al., 1995). Sclerotia formation of R. solani are initially developed from the combination of small groups of hyphae which arise from irregular branching of neighboring hyphae (Otten and Gilligan, 1998).

Environmental factors such as cool temperatures, wetter soils, high humidity, planting date, winter temperatures, and disease levels in the previous wheat crop has been recorded to influence the occurrence on the field (Meyer, 2002). Kataria and Verma in 1992 found that the most virulent AGs of R. solani towards wheat were those that belonged to AG2-1 and AG4 causing pre- and post-emergence damping off, seedling root rot or basal stem disease.

2.2 Biology of Rhizoctonia spp.

The original concept that Rhizoctonia spp. causes rotting of roots and damping off of seedling was first observed by Ogoshi(1975), with an assumption that isolates of R. solanibelong to basidiomycetous imperfect fungus. R. solanidono produce any asexual spores (also called conidia), despite the absence of asexual spores this fungus are recognized by some specific characteristic features such as their mycelia. R. solani possess these characteristics features, which include

i. Branching near the distal septum of cells in young vegetative hyphae (8-12 µm)

ii. Presence of hyphae and septum (Weber, 2009)

iii. Formation of septa from a point near the origin of hyphal branches (Parmeter and Whitney, 1970)


v. Absence of conidia sclerotia (Ogoshi, 1987)
The isolates of Rhizoctonia spp. tend to produce a simple or branched chain of cells called moniliod cells or chlamydospores. The moniliod cells chain is formed on or above the surface of a host plant or a media substrate aggregating to form sclerotia. It has been recorded that hyphae of the same AG group of R. solani are able to fuse and are therefore genetically isolated despite being morphologically similar (Ogoshi, 1996, Sneh et al., 1991). Rhizoctonia spp. can be identified according to number nuclei present in each cell. The number of nuclei produced per cell of Rhizoctonia is then used for taxonomic identification purposes (Kuramae et al., 2003). R. cerealis has been recognised as a binucleate species having two nuclei and R. solani as a multinucleate species, with at least three nuclei in eachcell. Further classification of Rhizoctonia spp. are grouped base on their ability to fuse with one another through anastomosis (Sneh et al., 1991, Ogoshi, 1996). However, some researchers recognise R. solani as a group of filamentous structure which are based on their hyphal fusion, known as called Anastomosis groups (Anderson, 1982, Ogoshi, 1987).

2.3 The geographical distribution of Rhizoctonia spp.

Rhizoctonia spp. are plant pathogenic fungi that are distributed world-wide with a wide range of host plants. They cause a great loss in wheat quality and production due to this disease (Sayler and Yang, 2007). The global discovery of Rhizoctonia occurrence more than 100 years, existing as a thread-like growth on plants or in culture. Report on global distribution of R. solani wheat production are limited to US Pacific, South Africa, Australia, Turkey, Canada (Demirci, 1998), United Kingdom (Dillion and Garrett, 1943), Africa and Asia (Hammouda, 2003; Tsuda et al., 2000), Oceania (Cromeyet al., 2002; Cromey et al., 2006), North America (Wiese, 1987), and Asia (Tsuda et al., 2000) (Figure 1). The universal nature of R. solani over the last 30 years is yet to be recognised. The geographical distribution and development of plant disease which depends much on the climatic factors such as rainfall, humidity, temperature etc. The spread of R. cerealis has been suggested to be a climatic change, and the global dispersal of susceptible varieties or the large host variety of the pathogen (Hamada et al., 2011). Due to the global distribution of Rhizoctonia pathogens causing disease in wheat, there is an ongoing research on the taxonomic amendments of teleomorphs for these anamorphic fungi (Dillion and Garrett, 1943, Papavizas et al., 1975).

2.4 Anastomosis (hyphal fusion)

In the last 35 years, the system of anastomosis grouping of Rhizoctoniahave been based on hyphal fusion among several fungi that consist the genus (Sneh et al., 1991, Anderson, 1982). The anastomosis of Rhizoctonia spp. can be defined as the union of two fungal hyphae between different isolates of Rhizoctonia (Naito, 2006). These are classified with an isolate tester which are describe based on their anastomosis reaction between the fungal hyphae (Naito, 2006, Sneh et al., 1991). In the previous studies, terminologies to define anastomosis has been divided into four different types of category to describe their reaction between paired fungal hyphae (Carling, 1996). This includes:

i. C0 - No fusion nor reaction (Neate and Warcup, 1985)
ii. C1- Contact fusion
iii. C2 - Imperfect fusion
iv. C3- Perfect fusion (Ogoshi, 1987, Sneh et al., 1991)

C0 indicates that there is no fusion (contact) between different anastomosis groups (AGs) of the hyphae and are not related genetically (González García et al., 2006); C1 show that there was no clear penetration (Figure 2).
Figure 2. Anastomosis reactions of *R. solani*. strain (a) No reaction, when strains of different anastomosis groups show no hyphal attraction. (b) Incompatible reaction, when strains of the same anastomosis group but with different vegetative compatibility genes undergo hyphal fusion, (c)Imperfect fusion and (d) Perfect fusion (Garcia *et al.*, 2006, Robinson & Jim Deacon).

### 2.4.1 Anastomosis groups of *Rhizoctonia* spp.

The anamorphic classification of Rhizoctonia isolates are based on characterization of the cell’s nuclear condition, their vegetative hyphae and hyphal anastomosis. Research carried out by Cubeta and Vilaglys (1997) grouping of Rhizoctonia anastomosis haveindeed advanced our understanding of their genetic diversity within Rhizoctonia species.

The perfect fusion of AGs of *Rhizoctonia* spp. can be determined when C3 reaction (Figure 2) are observed between a pair of isolates indicating a genetic or nearly genetically related between Rhizoctonia isolates. Recent studies on the anastomosis reaction of Rhizoctonia isolates has shown variability within and between AG’s (Neate and Warcup, 1985). Moreover, this C3 reaction has been considered insufficient for accurate identification and classification of the isolates, because some isolates lose the capability to self-anastomose (Ogoshi, 1996, Sneh *et al.*, 1991). Some will not anastomose with all isolates of the same AG and some anastomose with isolates of more than one AG (Ogoshi, 1987, Sneh *et al.*, 1991). Research in further studies has also shown that AG’s have levels of host specificity and currently fourteen different AG’s of *R. solani* are recognised (AG-1 to AG-13 and AGBI) including isolates from many crops. According to research work of Burpee *et al.*, 1980; *Rhizoctonia* species were assigned to one of these seven AGs termed CAG-1 to CAG-7. This seven AG’s have been subgroups into further division (AG-1, AG-2, AG-3, AG-4, AG-6, AG-8 and AG-9) (Burpee and Martin, 1992) to reproduce the differences in the occurrence of anastomosis, pathogenicity, and cultural appearance among isolates. However till date, 12 AGs of *R. solani* have been described (AG 1 to AG 11, plus AG B1) which are based on their hyphal fusion (Gill *et al.*, 2001a). The identification of these isolate are majorly on the basis of appearance of mature colonies on PDA in petri dishes whether *R. solani* or on *R. cerealis*. To test for the hyphal anastomosis, an isolate of the unknown AG will be co –cultured on water agar with a tester isolates of a known AG (Tsai *et al.*, 2012, Tu and Kimbrough, 1973). This anastomosis grouping generally helps with the understanding of diversity and sequence information among*Rhizoctonia*species supporting the existence of genetic distinction in the AGs (Sharon *et.al*, 2008) of most widely studied species.

### 2.5 Host Range of *Rhizoctonia*

*Rhizoctonia* spp. are distributed widely in a great diversity on their host plant (Table 1) (Savler and Yang, 2007, Ganeshamoorthi and Sunil, 2013). The host range of *R.solani* has been has been assumed to have at least 14 anastomosis groups (AGs) reported by Carling 1996 and Sumner *et al.*, 2003. Rhizoctonia species other than *R. solani* and *R. cerealis* are believed to have little or no role in causing disease towards various crop especially wheat (Zhang and Dernoeden, 1997).

### 2.6 The Disease: Infection and Disease Symptoms of *Rhizoctonia* on wheat

#### 2.6.1 Disease symptoms

Rhizoctonia primarily affect the host’s stem and root due to its saprophytic nature both below and above ground the soil surface (Bailey *et al.*, 2000). Rhizoctonia fungussurvives and develops to attack tips, hairs root and stem of wheat (Weller *et al.*, 1986; Mazzola *et al.*, 1996). In previous studies, multinucleate isolates belonging to anastomosis groups (AG) 2–1, 2–2 and 8 of Thanatephoruscucumeris were most pathogenic to wheat (Roberts and Sivasithamparam, 1986). It has been suggested that the bare patch disease is caused by a complex of root rot fungi composed of one or more anastomosis groups of *Rhizoctonia* spp. and other associated fungi. *Rhizoctonia* spp. are accountable for diverse types of infected diseases on wheat production (Fletcher *et al.*, 2010) under hugely differing environmental conditions. Wheat seedling infection caused by isolate of *R. solani* AG 2-1 are more favourable to cool weather at their sowing dates in spring whereas for AG-4 isolates, warmer environment are conducive for damping-off to grow.
(Yitbarek et al., 1988, Ogoshi, 1996, Sneh et al., 1991). In a country like China, sharp eyespot is principally caused by the Rhizoctonia cerealis, the anamorph of Ceratobasidium cereale D.I. Murray and Burpee. Although the disease pathogenicity of R. solani AG’s such as AG1-IB, AG2, AG4 and AG5 and some other factor causes infection in wheat which eventually makes the plant very weak and stunts growth.

Among these important factors include the interactions between plant and pathogen (Strange and Scott, 2005) and the initial concentration of the inoculum (inoculum density), as well as the severity of Rhizoctonia. These infections caused by Rhizoctonia spp. on wheat crop are affected at the host’s roots, leaves, and stems of the host due to their saprophytic nature.

**Table 1. Host range summary of Rhizoctonia solani and Rhizoctonia cerealis isolate based on their relationship (both multinucleate and binucleate) recognised with different disease and their host. Their biological species which are different from Thanatephorus cucumeris are names with question marks.**

<table>
<thead>
<tr>
<th>Anastomosis group</th>
<th>Diseases</th>
<th>Host Plant</th>
<th>Teleomorph</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG 1-IA</td>
<td>Leaf blight, summer blight, brown patch, sheath blight and sheath spot</td>
<td>Rice, corn, sorghum, bean, soyabean, turgass</td>
<td>Thanatephorus cucumeris (=Corticium sasakii; T. sasakii?)</td>
</tr>
<tr>
<td>AG 1-IB</td>
<td>Web blight, rot, bottom rot</td>
<td>Bean, rice, soybean, leguminous woody plants, cabbage, lettuce, buckwheat, carrot, soybean, flax, pine</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 1-IC</td>
<td>Damping off and crown root rot</td>
<td>Buckwheat, carrot, soybean, flax, pine</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 2-1</td>
<td>Damping off, bud rot, leaf blight, root rot</td>
<td>Crucifers, strawberry, subterranean clover, wheat</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 2-2 IV</td>
<td>Root rot, leaf blight, and large patch, and black scurf</td>
<td>Sugar beet, turfgrass</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 3</td>
<td>Leaf blight, brown spot</td>
<td>Potatoes, tobacco, tomato, eggplant</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 4 (HG I, HGII and HGIII)</td>
<td>Fruit rot, stem rot, damping off and stem canker, root rot</td>
<td>Tomatoes, pea, potato, soyabean, onion, peanut, potato, turf grass, beans, beans</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 5</td>
<td>Black scurf, brown patch and root rot</td>
<td>Potato, turf grass, beans, beans</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG6(HG-I and GV)</td>
<td>Non-pathogenic group</td>
<td>-</td>
<td>T. pratcola?</td>
</tr>
<tr>
<td>AG 7</td>
<td>Non-pathogenic group</td>
<td>-</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 8</td>
<td>Bare patches</td>
<td>Cereals</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 9</td>
<td>Weak pathogen</td>
<td>Crucifers, potatoes</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 10</td>
<td>Non-pathogenic group</td>
<td>-</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG 11</td>
<td>Non-pathogenic group</td>
<td>Wheat, rye, oats, barley, corn, rice, grasses</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG BI</td>
<td>Non-pathogenic group</td>
<td>Barley, maize, rye and other Poaceae species</td>
<td>T. cucumeris</td>
</tr>
<tr>
<td>AG-D I, II, III (Rhizoctonia cerealis)</td>
<td>Sharp eyespot</td>
<td>Wheat, barley, oats, maize, rye and other Poaceae species</td>
<td>Ceratobasidium cereale</td>
</tr>
</tbody>
</table>

(Strange and Scott, 2005, Sneh et al., 1991, Ogoshi et al., 1983)

### 2.6.2 Damping off caused by R. solani

Damping-off, a fungal disease caused by Rhizoctonia pathogen, tends to infect plant seedlings. This either kills the plant either before or after germinating from the soil (generally known pre-and post-emergence damping off). Infected seedlings not killed by the fungus often have cankers which occurs by degenerating stem and root tissue at the stem and below soil line (Sneh, 1996). Most wheat seedlings are most susceptible to disease at their juvenile stage when the environment is favourable (wet weather and warm soil). Damping-off can be considered based on their invasion occurrence with symptoms of reddish-
brown lesions sometimes rotting completely or leaving behind a discoloured stump

2.6.3 Root disease caused by *Rhizoctonia* spp.

There are various diseases that affect cereals especially wheat. Among these are *Rhizoctonia* root rot (Sneh et al., 1991), *Rhizoctonia* patch, and bare patch (Dillon and Garrett, 1943, Garrett et al., 2006). *Rhizoctonia* root rot is more frequent and severe under reduced or conservation tillage (Oros et al., 2013). With a close inspection of infected seedlings on the field, this shows brown discoloration or rotting of the roots indicate ‘spearing tips’ (Figure 3). *Rhizoctonia* is most evident as bare patches in a young crop plant (Figure 4). Close inspection of infected seedlings shows brown discoloration or rotting of the roots (Ogoshi, 1996, Sneh et al., 1991). Diseases caused at the root region are majorly characteristics above the ground such as expansion of circular stunted patches and chlorotic plants. The maturation of crop are delayed for more than two weeks by the damages caused in the both absence and presence of patches of stunted plants (Mazzola et al., 1996)

![Figure 3. Spear-tipping symptom caused by Rhizoctonia root rot (bare patch) – with lesion at the tip of the root)](image)

![Figure 4. Brown bare patch (patches formed as a result of the sclerotia effect on the soil, debris and the plant) are caused by *R. solani*. (Macnish and Neate, 1996)](image)

2.6.4 Sharp eyespot caused by *R. cerealis*

Sharp eyespot, are common stem based disease caused by *R. cerealis*, commonly found in wheat (*Triticum aestivum*). However, sharp eyespot symptoms are easily identified at later growth stages GS 39 (flag leaf out) (Zadoks et al., 1974). Plants that are affected shows lesions on the outer leaf sheaths near the base of the plant with a pale cream centre with a dark brown, sharply defined edge progressively extend through the leaf sheath layers (Figure 5) (Pitt 1964). Severe sharp eyespot infection of mature tillers may result in small, shrivelled grain, lodging and premature ripening. Sharp eyespot, generally known as stem based diseases are found throughout temperate wheat regions in the world (Lemańczyk, 2012). The average yield losses in wheat production over last five seasons in UK caused by *R. cerealis* is 5% moderate infection and 26% severe infections (Cromey et al., 2002). Wheat productions in China are majorly affected by sharp eyespot which has brought serious threat to crop production with estimated loss from the years 2005 to 2008 (Chen et al., 2008). Primarily sharp eyespot shows an oval-shaped lesion which grows on basal leaf sheaths, lower stem becomes brown in color cause stunting and reduction in tillers.
2.6.5 Effect of disease caused by Rhizoctonia in wheat

Root rot reduces the number of roots available for the plant nutrient and water uptake been disrupted. The record of disease incidence and severity caused by *R. cerealis* (sharp eyespot) (Colbach et al., 1997), has been a result of increase in the fungicide use, increase in the distribution of disease due to the environment. The wheat cultivars are more susceptible to *R. cerealis* (Cromey et al., 2005), and the occurrence of disease incidence tends to affect continual cropping of cereal crops (Clarkson, 1981, Clarkson and Cook, 1983). The major problem associated with damping-off is that this disease contributes to poor establishment of plant structure. Crop losses caused by the Rhizoctonia disease occurrence and development in plants are due to the interaction between the host, pathogen, environment, with man being the ultimate cause of disease, as conceptualized by the disease triangle. The effect of source, dispersal and reproduction of Rhizoctonia inoculum bring about loss in crop production. The yield and quality of wheat are reduced due to the impact of this disease pathogen.

2.7 Rhizoctonia life cycle

The disease cycle of *R. solani* is important in regards to management and control of the pathogen. *R. solani* can survive for many years by producing small, irregular-shaped, and brown to black structures known as sclerotia, in soil and on plant tissue. There are certain pathogens of *R. solani* which have evolved the ability to produce sclerotia with a thick outer layer that allows them to float and survive in water. *R. solani* also survives as mycelium by colonizing soil organic matter as a saprophyte, particularly as a result of the pathogenic activity of plant. Sclerotia and/or mycelium already present in the soil and/or on plant tissue germinate to produce vegetative threads (hyphae) of the fungus that can attack a wide range of food production (Figure 6).

![Figure 6. Disease cycle and the infection process of Rhizoctoniasolani. Initiation of the actual infection process is indicated by the two thick black arrows (Keijer1996) - Note: the dark brown edge around the pale cream centre](image)

The fungus, Rhizoctonia, is attracted to the plant by chemical stimulants released grown on plant cells and decaying plant residues (Naito, 2006). During the attraction process, the fungal hypha will come in contact with the plant and become attached to its external surface. After the fungus is attached to the plant, it grows continually on the external surface of the plant and then produces a specialized infection structure (either an appresorium or infection cushion) penetrating into the plant cell and releases nutrients for the fungal to survive, grow and develop (Naito, 2006). The infection processes are promoted by the production of many different extracellular enzymes that degrade various components of plant cell walls. As the fungus kills the plant cells, the hyphae then continue to grow and colonize the dead tissue of the plant cell, often forming sclerotia. The production of new inoculum is produced on or in a host tissue, and a new cycle are repeated when new substrates become fresh on the new plant emerging (Figure 7).
2.8 Epidemiology of Rhizoctonia diseases

Epidemiology can be defined as the study of disease in the population of pathogen interaction with the population of host plant (Jeger, 2001, Cooke, 2006). In other words, epidemiology can be defined as the interaction between a susceptible host (for example, winter wheat), a virulent pathogen (R. solani) under a favorable conditions. Rhizoctonia primarily causes disease and attacks majorly the stem and root regions (Ogoshi, 1987). Epidemiological studies of plant entails monitoring, experiments on loss assessment (Anderson, 1982), forecasting (Blumenthal et al., 2001), analysis and modelling of disease progress (Waggoner and Aylor, 2000) to assess the disease risk and to formulate better management strategies (Zadoks, 2001). In the past years, the ecological and the epidemiological studies record of Rhizoctonia disease has resulted in a significant knowledge of their variation, variability, virulence, physiology mode of their infections (Sayler and Yang, 2007) which are largely determined by their soil or climatic condition. It has been suggested that infection by the fungus R. solani slowly increases with increasing soil moisture content (from 30 to 80%) and vice versa (Verma, 1996). Scientific research based on the disease severity/complexity is greatly needed, particularly in areas where rapid field diagnosis, disease epidemiology and efficacy vector control are required for better management (Jeger, 2000).

Figure 7. Disease cycle of *Rhizoctoniasolani* (Image taken from the Compendium of Turfgrass Diseases, APS Press) – (Tredway and Burpee, 2001)

2.8.1 Source and survival of inoculum

The ability of this pathogen to establish disease depends on the susceptibility of the host to the pathogen. Environmental factors like moisture and temperature also play an important role in the survival of Rhizoctonia pathogen whilst establishing plant disease epidemics (Otten et al., 2003, Otten et al., 2004). The climatic condition is an important factor that relates epidemic development which varies widely from disease to disease. The formation of sclerotia (which act as source for the inoculum to survival), also permit the pathogen to survive without a host.

Figure 8. Plant disease triangle. The three necessary causal factors of disease. Disease triangle recognises the interaction of a virulent pathogen population with a susceptible host population in a conducive environment (Francl, 2001).
inside the debris in the soil or organic matter (Papavizas et al., 1975). Given the quantity of inoculum present in the soil, pathogens are easily transmitted to wheat seedlings and cause diseases (Jeger, 1987, Jeger and Van Den Bosch, 1994). Crop residue, stem, leaf debris and living plant are important sources of inoculum for the development of disease caused by R. solani and R. cerealis.

### 2.8.2 Dispersal of inoculum

Basidiospores serve as a means of dispersal of the Rhizoctonia spp. The dispersal of spores (known as basidiospores are initiated at high relative humidity and warmer temperature conditions (≥ 90% and ≥ 20°C respectively) (Naito, 1996). Under these conditions, basidiospores permit long distance dispersal of the fungus (Agrios, 2005). Rhizoctonia spp. produce basidiospores (reproductive spores) that lead to foliar diseases in some host crops. The role of basidiospores in disease epidemiology is yet to be clearly established since it can vary within AGs and between subgroups (Naito, 2006).

### 2.8.3 Reproduction of Rhizoctonia spp. Inoculum

Rhizoctonia spp. reproduces both sexually and asexually (Ogoshi, 1996; Roberts, 1999). Spores and fungal mycelia act as fruiting structures in inoculum production of pathogen of Rhizoctonia spp., which consists of the spore-bearing formation (Naito, 2006). The fructification of T. cucumeris occurs when environmental factors, such as air and soil temperature, relative humidity including high level of oxygen (O₂) and carbon dioxide (CO₂) concentration are present (Naito, 2006). Asexual reproduction of Rhizoctonia is achieved by means of fungal hyphae (sclerotia), mycelium and by spore-formation (basidiospore) (Anderson, 1982, Anderson et al., 2004).

### 2.9 Factors affecting disease development caused by Rhizoctonia spp.

Rhizoctonia infections are established in the presence of virulent pathogen, susceptible host and availability of other environmental factors that either enhances Rhizoctonia pathogenicity or host susceptibility to infection (Figure 8) (Francl, 2001; Agrios 2005).

#### 2.9.1 The pathogen

Factors that determine the occurrence of disease depend on the absence or presence of Rhizoctonia pathogen. The outbreak of disease in a plant community is initiated by the introduction of pathogen to that environment or in a specific area. The extent of disease which develop on winter wheat are mostly determined by the pathogenicity of the Rhizoctonia. The pathogenicity of Rhizoctonia are majorly related to the virulence (the ability of pathogen infection), and the vigour of the infection caused by this pathogen (inoculum density). The ability of the Rhizoctonia pathogen to adapt depends on their survivability in that environment, how it can dispersal over a long period of time. Rhizoctonia being a soil-based pathogen can survive in the soil for years and the amount of infective propagules which are available in the soil or crop debris tends to be a crucial factor affecting the growth and development of Rhizoctonia disease in T. aestivum (wheat). The survival of this infective propagules in the soil are influenced by the environmental factors (Section 2.8.3) that are suitable for the growth of disease pathogen.

#### 2.9.2 The host

A susceptible host is another factor that causes disease development in a plant community. The important of planting of uninfected cultivar tends to reduce the effect of Rhizoctonia on winter wheat production. An extensively dense plantation can host epidemics, particularly if those anastomosis groups of Rhizoctonia are not present in that environment. The population structure and density will also affect the development of disease in a plant community. The density of the main host species and the proportion of other plants that are not hosts within the community will determine the rate and extent of epidemic development.

#### 2.9.3 The environment

##### 2.9.3.1 Temperature and Weather condition

Temperature is one of the major physiological factors that affect crop production (Gugel et al., 1987, Yibarek et al., 1988). When the weather condition is humid and temperatures are stressful to the grass, Rhizoctonia Brown Bare Patch tends to develop which is been recorded as is one of the most destructive Rhizoctonia pathogen. Gill, et al. 2001 viewed R. solani anastomosis group (AG8), with a conclusion that significant damage are caused when the temperature lower than 6 to 19°C at the root region, or when temperature which ranges from 16 to 27°C. Greater growth of R. cerealis occurs on soil at 20°C but slower growth occurs at 10°C indicating that temperature may be a factor of increased decomposition of soil organic matter (Herman et al., 1992b). Disease severity was recorded at 10°C, advocating that cereal disease suppression occur in soil at higher temperatures. However, these Rhizoctonia pathogen disease are mostly favoured by temperatures of around 9-10°C (Wiese, 1987). Soil temperature and moisture play major roles in the development and spread of root diseases in wheat. A laboratory based studies was carried out by Herman (1992b) and found out that the influence of temperature majorly depended by the moisture content levels. There are various optimal ranges of temperatures affecting the AGs, both in disease growth and infection caused by R. solani. Change in climate constantly affect plants both in the natural and agricultural environments throughout the world (Anderson et al., 2004, Garrett et al., 2006). Temperature has a great influence on the growth and pathogenicity of R. cerealis, with pathogen prevalence and growth optimum at 16 to 20°C (Abdelshife and Jones, 1981).

##### 2.9.3.2 Soil moisture content

Soil moisture levels on the incidence of R. cerealis were found to be similar in the results gathered by Gill et al. (2001b) in the laboratory and glasshouse. The disease incidence was observed to be higher in dry soils than in wet soils in his studies using non-sterilised soils (Gill et al., 2001a). However, the authors found no difference in disease incidence at various soil moisture levels in sterilised soils. The soil environment tends to favour microbial spread of disease of R. solani and R. cerealis (Gill et al., 2001b, Otten and Gilligan, 1998). Previous and ongoing research on the interaction between plant-soil-water relationships has not been successful given the inappropriate use
of quantity of water-holding capacity (Cook and Papendick, 1972). The presence of \textit{R. solani} AG8 at soil moisture levels between 15 to 75% water holding capacity (WHC) has arguably been associated with high pathogen prevalence in the roots and subsequently taking its toll on wheat growth and development (Gill et al., 2001a, Gill et al., 2001b, Otten and Gilligan, 1998). The dry weight of root in an inoculated soil was related to soil moisture level, bringing a decline as WHC fell from 75% to 15%. This has led to a conclusion that at high moisture levels microbial activity is increased to a level that suppresses the pathogen.

2.9.3.3 Soil texture and pH

The spread of \textit{Rhizoctonia solani} on the soil surfaces tends to be faster when the soil profile is conducive to cause causing damping-off in wheat seedlings (Otten and Gilligan, 1998). Sandy soil has been recorded to be more favorable for \textit{R. solani} (AG8) to spread, survive and grow compared to an heavier texture of soil resulting in greater loss in dry root weight. This was also supported by Otten et al. (2004a) who found that infection occurred quicker in sandy soil than othersoils. Gill et al. (2000) described the influence of soil texture in plant pathogen invasion. A wet soil has tendency of producing inoculum which causes a greater infection to crop (Gilligan and Bailey, 1997). Sharp eyespot caused by \textit{R. cerealis} is favoured when the soil pH is acidic to some extent (Pitt, 1966, Pitt, 1964). The texture of soil has been the major factor influencing incidence of diseases such as sharp eyespot. Over 70% of the disease incidence of sharp eyespot has been recorded in the UK according to the observation by Pitt (1964) on light sandy soils. Further studies on the effect of soil was carried out by Daamen and Stol, (1990) indicated that the prevalence of sandy soils has been a major factor influencing disease occurrence.

2.9.3.4 Fertiliser use

The incidence of Rhizoctonia root rot can be reduced by the application of some nitrogen fertilizer such as ammonium sulphate, urea or sodium nitrate to fields (MacNish, 1985). However, Pumphrey et al., (1987) found that the applications of nitrogen fertiliser had no effect on Rhizoctonia root rot. This was later supported by MacNish (1988) who observed that N fertiliser failed to affect the incidence of Rhizoctonia root rot. Gill et al., (2000) observed that the nutrient status of the soil had no influence on the pathogenicity or spread of the pathogen. Among the minor plants nutrients, the only one previously found to be inversely correlated to the incidence of root rot disease in wheat has been found to be zinc (Zn) (Thongbai et al., 1993). The impact of applying high amount of nitrogen fertilizer to winter wheat production, particularly during spring and summer, favors development of Brown Patch by producing lush, succulent growth that is very susceptible to Rhizoctonia infection. Other factors increase disease severity by creating a humid environment favorable for growth of Rhizoctonia fungi. These factors include: overwatering, watering in late afternoon, poor soil drainage, lack of air movement, shade, a high mowing height, and overcrowding of seedlings. Excessive thatch, mowing when wet, and leaf fraying by dull mower blades also can enhance disease severity.

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Host</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of pathogen</td>
<td>Crop susceptibility</td>
<td>Temperature</td>
</tr>
<tr>
<td>Pathogenicity</td>
<td>Growth stage &amp; form</td>
<td>Rainfall</td>
</tr>
<tr>
<td>Adaptability</td>
<td>Population density &amp; structure</td>
<td>Leaf wetness period</td>
</tr>
<tr>
<td>Dispersal efficiency</td>
<td>General health-Nutrient status</td>
<td>Soil properties</td>
</tr>
<tr>
<td>Survival efficiency</td>
<td></td>
<td>Wind</td>
</tr>
<tr>
<td>Reproductive fitness</td>
<td></td>
<td>Fire history</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Herbicide damage</td>
</tr>
</tbody>
</table>

Table 2. General factors that affect Rhizoctonia disease development.

2.10 Control Measure

Control measure may be divided broadly into three- via crop management, biological and chemical means. Crop management is the considerable measure of crop manipulation for controlling the disease outbreak caused by Rhizoctonia.

2.10.1 Application of epidemiological principles to achieve plant disease control

There are several number of practices that illustrate particular epidemiological principles to reduce and control wheat disease caused by Rhizoctonia. Management of this disease effectively entails an application of integrated disease management approach and knowledge of each growth and development stages. The impact of source disease inoculum has emphasized the importance of strategies for controlling \textit{R. solani}. Control of \textit{R. solani} and \textit{R. cerealis} which infect wheat requires the understanding of survival and dispersal of soil borne pathogen inoculum to provide information on disease management decisions.

2.10.2 Disease Control by Reduction of Initial Inoculum

Plant epidemics often result in loss of production, financial hardship to farmers and producers unless there is an appropriate control measures. The increasing knowledge of the interaction between host-pathogen-environment disease triangle has enabled us to apply certain principles to control disease invading wheat.
production (Jones, 2004, Anderson et al., 2004). Reducing the loss in wheat production caused by Rhizoctonia disease can generally be achieved if management efforts aim to eliminate the initial pathogen inoculum; discontinue the incidence and appearance of the inoculum production by slowing down the increase rate of disease and the time of exposure of the crop to the pathogen. These losses and damages caused by Rhizoctonia can be reduced by controlling epidemics using measures that minimize disease infection sources or suppress spread this disease. However, the ‘economic threshold’ varies with factors such as plant density, duration and pattern of infection, the extent to which infection decreases over yield and quality.

2.10.3 Cultural Method

MacNish (1985) suggested that ploughing or cultivation down to 8-10cm depth can be an effective cultural control option for Rhizoctonia. Timely elimination of volunteer plants and grass weeds, is seen as the most significant cultural control option for the control of Rhizoctonia root rot(Cook et al., 1991, Cook et al., 2002). Crop succession, soil tillage and sowing date are incidence factors that also influence the occurrence of sharp eyespot (Colbach et al., 1997).

2.10.4 Biological control

Chen et al. (2010) showed that when agronomic practices such as straw mulching were performed, Pseudomonad spp. increased and a suppression of sharp eyespot occurred. This demonstrated that it may be possible to induce bio-control agents through agronomic practices., as well as the biological control of Rhizoctonia solani by indigenous Trichoderma spp. Isolates (Budge et al., 2009).

2.10.5 Host resistance to R. solani and R. cerealis

The use of natural resistance expressed by the host is the most sustainable approach for soil-borne pathogens which are difficult to control chemically, with fumigation being an expensive and often temporary solution (Panella and Ruppel, 1996). There are however variations in the level of access to Rhizoctonia root rot-resistant wheat varieties among growers (Fletcher et al., 2010). The level of resistance to sharp eyespot have differed among cultivars over the years (Hollins and Scott, 1983).

2.11 Identification of Rhizoctonia spp.

Molecular approaches used for the identification of the pathogen R. cerealis within infected wheat plants include PCR-RAPD (random amplification of polymorphic DNA) (Turner et al., 2001), also suggested that molecular methods could be applied to discriminate infection by R. cerealis. Although RFLP, AFLP and RAPD-PCR are very effective molecular techniques for differentiating among R. solani AGs, conventional and real-time PCR are the preferred molecular techniques as they allow for the rapid detection of a particular R. solani AG present in plant tissue and in soil.

REFERENCES


Spatial and Temporal Dynamics of the Soil *Rhizoctonia solani* Ag-1 Ia, the Rice Sheath Blight Pathogen, in Rice Using Real-Time Per. Plant Disease, 91, 1663-1668.


eHalalCosmetics4u: Combining Faith and Beauty in Crafting the Perfect Makeup for Muslim Women

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1, 2, 3, 4 Kulliyyah of Information and Communication Technology, International Islamic University Malaysia

Abstract—This paper proposes a customer to customer or C2C service platform, named eHalalCosmetics4u. This trusted conceptual platform serves Muslims to sell and buy variety of quality and Halal cosmetic products at affordable price through online as well as through network of mosques. This platform has the ability to provide convenience, secured and friendly interfaces to advertise, sell and buy halal cosmetics products. Literature reviews, nine (9) blocks of Business Model Canvas (BMC) and Value Proposition Design Canvas (VPC) framework and interviews are used as methodology for this paper.

Index Terms– online Halal cosmetics, Network of Mosque, Business Model Canvas, Value Proposition Design Canvas.

I. INTRODUCTION

There are 62% of Muslim population lives in the Asia-Pacific region. As a Muslim, Halal is the most important thing in all aspect of life. However, Abdul Malik Mujahid (April 11, 2017) said that “Muslim consumers are often criticized for not doing enough to support Muslim businesses, whether it's paying the extra dollar (or two or three or four) to buy products, or to drive the extra mile (or two or three or four) to get to the store”. So, we come up with eHalalCosmetics4u. It is a platform C2C for Muslims to sell and buy halal products. This Website has the ability to provide convenience and more users’ friendly environment to sell and buy the halal products. The website let users to visit its content at any time they want either for the purpose of buying or not. Moreover, the system does require customers to sign up for login into website. Also for Muslims or any users who want to advertise, buy, or sell their products, so they are compulsory to sign up as well. Furthermore, this application does not only do advertising, buying and selling Halal cosmetics beside that do the process of transaction inside the system. Some advantages of the website are that customer can easily select and buy halal products in short amount of time because the cosmetics are already categorized on the website based on the types. In addition, Muslims or anyone is able to find and view ads easily. Besides that, customers can save time from browsing the unwanted information. Then, online halal cosmetics shop enables the customers to rate the products for sale and buy.

II. BACKGROUND

The fast growing of technology give a great chance to create a new application to solve problems facing by customers. One of the usages of this website is online purchasing and online advertising. People tend to buy halal cosmetics online with the trust in this system because JAKIM will verify the halal certification from seller before the product being sold. Based on the research and observation, Muslims face difficulties in searching and buying halal and Shariah compliant cosmetic products. Unfortunately, current online cosmetics systems such as LAZADA, Sephora do not indicating halal status. Hence, the main purpose of this platform is to help Muslim to buy and sell halal cosmetics products through online. At the same time, this platform will contribute part of its revenue to the poor and Masjid.

III. PROBLEM STATEMENT

It has been found that Muslims always face with hard time to look at the halal products. Also there is always a problem to find a purchase product which follow Syariah laws. Due to the existing system such as in LAZADA, or Sephora, Muslims are experiencing problems to find the desired halal cosmetics. Cosmetic is any product applied to the body, especially the face to improve its appearance namely, skin care cream, makeup, beauty aids and so on. Moreover, people cannot trust the halal logo that press on the product is the real one because there are many fake halal products that selling in existing system or via online. Shahidan Shafie stated that from the research he has done can be indicated that there are many issues and challenges on the halal subject namely the introduction of halal logo by individual firms and the lack of enforcement by the authorities with regards to the misuse of halal logos. Therefore, it can be clarified that there are doubts among people - whether the products are halal or not because of misuse of halal logos. Based on the survey conducted among 100 cosmetics users in IIUM, only 25 of cosmetics users trust halal cosmetics in existing systems, with 75% of being sure. While other cosmetics users believe on the existing halal cosmetics with being sure of 50% and 25% respectively. Hence, Muslims are faced hardship to buy and sell halal goods in a trusted platform which follow Syariah rules and they face was-waas and majority of Muslims have not trust on halal logo press on the products.
IV. LITERATURE REVIEW

1. Market leaders
   1.1 Alibaba

   Alibaba is China’s largest online commerce company. It was found by Jack Ma in 1999. Alibaba provides e-commerce business, wholesales trade as well as other service such as electronic payment service, a shopping search engine and cloud computing. The mission of Alibaba Company is to facilitate everyone to buy or sell any product or anything online anywhere around the world. Alibaba Company launched Alibaba.com with English language for global market to connect Chinese manufactures with oversea invertors and launched Chinese commerce website called 1688.com for small business in China. With the growing of number of customers, Alibaba has become one of the most successful companies in Asia that has a huge customer base with operation 190 countries around the world.

   ![Figure 1: The Interface of Alibaba.com](image1.png)
   ![Figure 2: Business Model Canvas of Alibaba Company](image2.png)

   According to business model canvas of Alibaba Company (Figure 2), Softbank Corp is the biggest partner that hold one-third of Alibaba’s share followed by Yahooo. For the customer segment, the two main target customers are global investors that focus on worldwide market and domestic marketplace which aim small and medium business in China. Alibaba generates revenue from two main resources that are advertisement and collecting fees from customer. Moreover, Alibaba emphasizes on easy doing business anywhere by connecting to the internet. This is the main purpose of Alibaba Company is to ease those small companies in China to sell and get more benefit and encourage people purchase their desire products thought online.
1.2 Sephora.com

Sephora is French’s cosmetics stores found in 1969. Louis Vuitton Moet Hennessey (LVMH) owns it. Sephora offer cosmetics products include makeup, skincare, fragrance, nail color and hair care from various famous brands. Sephora first operated store in Paris in 1970 and continued to expand the store globally to other countries. Now, Sephora operates approximately 2,300 stores in 33 countries around the world. Furthermore, Sephora.com was launched in 1999 in U.S. and Canada in 2003. It becomes one of famous cosmetics website.

![Figure 3: Interface of Sephora.com](image)

Woman ranges from their teens to thirties are the target customers of Sephora since woman are more interact and socialize. Yet, the man products also available and the number of products seem growing surprisingly. Furthermore, the strategy of Sephora is to sell multiple high-end cosmetics products under one roof. Customers can effortlessly get multiple cosmetic brands in one place. Some large store offers some of drug store brands as well in order to expand the target of customers.

1.3 Halal Shop

Halal Shop is the e-commerce website owned by Muslim and located in Singapore. Halal Shop website offers various halal cosmetic products such as makeup, skincare, hair care, fragrance and supplement. The company emphasize on trading halal products brands. Halal comprises various critical aspects of manufacturing include the source of raw materials, storage and packing of the products. There will be a team of respective Halal certification bodies to test on all the products that will be sold in their website to ensure those products meet Halal certification standard.

![Figure 4: Interface of HalalShop.com](image)

In sum up, Alibaba is one of the largest online commerce companies owned by Chinese people. There are many types of products that are been promoted include apparel, electrical equipment, sports as well as beauty and personal care. On the other hand, Sephora and Halal Shop are the commerce websites that focuses on beauty contents. Sephora is known as one of biggest company that retail cosmetics through both physical stores and website. The example of halal cosmetics products selling via online is Halal Shop. This company provides platform for selling and buying halal products online. Therefore, those three companies have their own strength market and planning to run their business to be successful.
2. Summary of market leader

2.1 Business Model Canvas framework

Table 1: Comparison of 9 blocks between Alibaba, Sephora, and Halal Shop.

<table>
<thead>
<tr>
<th>9 blocks</th>
<th>Alibaba.com (Cosmetics Sector)</th>
<th>Sephora</th>
<th>Halal Shop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Key Partners</td>
<td>- Logistic partner&lt;br&gt;- Suppliers&lt;br&gt;- Softbank Corp&lt;br&gt;- Buyer&lt;br&gt;- Yahoo China&lt;br&gt;- Payment processors</td>
<td>- Cosmetic and supply companies&lt;br&gt;- Payment processors&lt;br&gt;- Buyer&lt;br&gt;- Cosmetic and supply companies</td>
<td>- Buyer&lt;br&gt;- Cosmetic and supply companies&lt;br&gt;- Brand owner&lt;br&gt;- Payment processors&lt;br&gt;- Delivery products</td>
</tr>
<tr>
<td>2. Key Activities</td>
<td>- E-commerce&lt;br&gt;- Payment instruction&lt;br&gt;- Manage information&lt;br&gt;- Establish forum for giving feedback</td>
<td>- Promoting products&lt;br&gt;- Customer support&lt;br&gt;- Capturing customer preferences&lt;br&gt;- Personalized service&lt;br&gt;- Delivery products&lt;br&gt;- Updating information</td>
<td>- Selling halal cosmetic products&lt;br&gt;- Payment&lt;br&gt;- Delivery products</td>
</tr>
<tr>
<td>3. Key Resources</td>
<td>- Jack Ma (founder)&lt;br&gt;- Technical employees&lt;br&gt;- Marketing&lt;br&gt;- Industry experts&lt;br&gt;- Dermatologist</td>
<td>- HalalShop.Sg&lt;br&gt;- IT people</td>
<td></td>
</tr>
<tr>
<td>4. Value Propositions</td>
<td>- Various types of products&lt;br&gt;- Trading function&lt;br&gt;- Safe payment service</td>
<td>- Many high-end cosmetic brands&lt;br&gt;- Authentic products&lt;br&gt;- Interactive service&lt;br&gt;- Social media</td>
<td>- Various halal products available&lt;br&gt;- Get halal products&lt;br&gt;- Interactive service&lt;br&gt;- Customer support</td>
</tr>
<tr>
<td>5. Customer Relationship</td>
<td>- Personalized and customized service&lt;br&gt;- Online customer service</td>
<td>- Interactive service&lt;br&gt;- Social media&lt;br&gt;- Customer support</td>
<td></td>
</tr>
<tr>
<td>6. Channels</td>
<td>- Website (Alibaba.com)</td>
<td>- Physical store&lt;br&gt;- Website (Sephora.com)</td>
<td>-Website (Halal Shop)</td>
</tr>
<tr>
<td>7. Customer Segments</td>
<td>- Those who prefer to buy equipment online</td>
<td>- Those who want to buy makeup and skincare                                               Buyer:&lt;br&gt;-Those who want cosmetic products&lt;br&gt;-Those who want to purchase online.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Seller:&lt;br&gt;-Those who want to sell their products through community platform</td>
</tr>
<tr>
<td>8. Cost Structure</td>
<td>- Media advertising&lt;br&gt;- Sponsoring&lt;br&gt;- Advertising&lt;br&gt;- Salaries to employees&lt;br&gt;- Technological infrastructure</td>
<td>- Employees' Salaries</td>
<td></td>
</tr>
<tr>
<td>9. Revenue Stream</td>
<td>- Membership fees&lt;br&gt;- Advertisements&lt;br&gt;- Value-added service&lt;br&gt;- Listing advertising fees</td>
<td>- Selling products&lt;br&gt;- Membership fees</td>
<td>- Percent from products sold</td>
</tr>
</tbody>
</table>
2.2 Key features

2.2.1 Alibaba.com
- Convenience checkout process
- Ease of shopping
- Various types of products including cosmetic and personal care products
- Self service
- Customer support
- Secure payment
- Huge market

2.2.2 Sephora
- Ease of shopping
- Convenience checkout process
- Good quality of products
- Multiple high-end cosmetic brands available
- Customer support
- Secure payment

2.2.3 HalalShop
- Several Halal products cosmetic brands
- Convenience checkout process
- Good quality of products
- Ease of shopping
- Reasonable price

3 Environment Map

3.1 Key trend

This era, Internet is widely use and everything including marketing, selling, buying also via online. To support, “The Internet economy (iGDP) market is expected to contribute 16% (US$90 billion) to the GDP by 2025, up from 4.3% in 2010 as the importance of Internet and digitally-connected solutions grows in the economy” (Frost and Sullivan, 2015). In addition, the trend of using mobile application also increased time to time. According to Frost and Sullivan (2015) showed the trend that “In Malaysia, mobile app downloads are set to cross 660 million by 2025, five times”. Thus, it will give sellers opportunities and give them the chance to reach new customers and extra income. As the internet can be access on the Smartphone or any tablets, so the use of those gadgets is also increasing.

3.2 Market forces

Currently, online shopping is more preferable due to various choices in purchase products. In the study of Frost and Sullivan (2015) showed that “Sales from online retail (eTail) to grow seven-fold to US$6.1 billion in 2020, riding on the high smartphone and Internet penetration, along with rising disposable incomes in Malaysia.” So, people use to go online shop more than physical store. It is because online shop is more convenient, save time, save petro expense and easy. For the seller perspective, Online Halal Cosmetic can act as side income or permanent income by posting their product with easy and friendly technology.

3.3 Macro-economic forces

Actually online shopping has been globally used for a long time, as Alibaba.com and Sephora.com have become worldwide-preferred online shopping website. Many people believe that entrepreneurship is one of the alternatives to increase people life.

3.4 Industry forces

Nowadays, online shopping has become popular as people prefer to buy things including cosmetic via online. Other than that, pressure from existing system Alibaba.com and Sephora.com make researchers come out with Online Halal Cosmetic website that focus more on Halal products and to sell and buy variety of quality products at affordable price.
Four lenses of innovation

4.1 Challenging Orthodoxies: Challenge your beliefs and underscores the “why why why” on challenging the status quo.
- Can I have more customers?
- How to become top website?
- How to make people trust on my product?

4.2 Harnessing Discontinuities: Understand the present heading in Trends in patterns of change.
- Big data analysis.

4.3 Leveraging Competencies & Strategic Assets: Leverage Resources in every which way possible, including Open Innovation.
- Using Bootstrap strategies

4.4 Understanding Unarticulated Needs: Understanding Needs of true customer and know customer perspective needs.
- Feedback
- Observation
- Survey

V. CONCEPTUAL SOLUTION

1. Initial Business Model

The Business Model Canvas (BMC) was initially proposed by Alexander Osterwalder (2010). It is a strategic management and lean startup template for developing new business models. It is a visual chart with elements describing a product's value proposition, key partner, key activities, key resources, customer relationship, customer segment, cost structure, and revenue streams. According to Figure 5, it shows the BMC of Online Halal Cosmetic business.

![Business Model Canvas for eHalalCosmetics4u platform](image-url)

Figure 5: Business Model Canvas for eHalalCosmetics4u platform
VI. VALIDATION OF INITIAL BUSINESS MODEL - BMC AND VPC

1. Validation of the Initial Business Model

Sets of questionnaires survey were distributed among communities of International Islamic University Malaysia (IIUM). The researchers have chosen this population because of their roles, values and contribution required for this study. The researchers used Google form survey methodology and the scope of this survey is the researchers want to evaluate the percentage of cosmetics users and do they know about existence of halal cosmetics. Moreover, the researchers research for if users are interested halal cosmetics so they considered those students that use cosmetics in their daily lives and 100 of respondents participated in this survey.

2. Analysis and discussion

From Figure 6, it shown that 69% said yes that online halal cosmetics shop encourages Muslims to be aware of existence of halal cosmetics and encourages them to start a halal business to improve Islamic knowledge. And 30% of respondents feel that maybe online halal cosmetics shop encourages Muslims to be aware of existence of halal cosmetics and encourages them to start a halal business to improve Islamic knowledge. While, only 1% of the respondents think that online halal cosmetics shop encourages Muslims to be aware of existence of halal cosmetics and encourages them to start a halal business to improve Islamic knowledge.

![Figure 6: online halal cosmetics shop aware Muslims to start a halal business to improve Islamic knowledge](image_url)

Majority of respondents said yes that online halal cosmetics will acknowledge them about halal cosmetics and it is as a Muslims served committee with 81 the percent. On the other hand, 19% of respondents feel that online halal cosmetics will not acknowledge Muslims about halal cosmetics and it does not serve Muslims as shown in Figure 7.

![Figure 7: online halal cosmetics play role of a committee to serve Muslims](image_url)

From figure 8, 56% of cosmetic users never use halal cosmetics due to they are not aware of existence of halal cosmetics and there are some respondents that sometimes use halal cosmetics with the percentage of 37. While, there are few users that always use halal cosmetics with 7%.
VII. ENHANCEMENT OF BUSINESS MODEL

1. Business Model Canvas (BMC)

Figure 9: Enhancement of Business Model Canvas: eHalalCosmetics4u

A. Customer Segment
As in Figure 5, Customer segments of eHalalCosmetics4u platform expect Muslim buyers and sellers as their users who have the same interest which are Halal products.

B. Value proposition
To help Muslim sellers earn additional income by offering platform for advertising, and getting wide Muslim customers as a center of Halal products. Furthermore, it easy for seller to promote their products by one clicks and also categorizes the product according to product type. In addition, it enables customers and buyers to rate and comments the product as well as buyers can view advertisement easily. Moreover, it is trusted website and mobile application.

C. Channels
Company channel is eHalalCosmetics4u.com website, mobile application that users can download free. Moreover, this platform also uses the concept of Network of Mosque (Dahlan et. al, 2016; Burhan et. al, 2013) which allows all people to visit this website without specific genders or ages. Thus, these company channels use to communicate with customers segments to deliver value proposition.
D. Customer relationship

Customer relationship block explains the type of relationships between company and customer segments by giving free registration for customer segments followed by the terms and condition stated. Next, customers are able to follow up new products or promotions via online Halal cosmetics website, Facebook page, and others social media.

E. Key resources

Key resources are the most important assets required to make a business model work. In this company, the key resources are eHalal Cosmetics4u platform, Internet connection, developers, delivers, and IT people.

F. Key activities

Key activities are the most important actions a company must take to operate successfully. For Online Halal Cosmetic, the key activities include develop platform, verify Halal product, practice C2C business model, the website updated frequently and partner development management.

G. Key partners

Key partners describe the network of supplies and partners that make the business model work. In this case, the Online Halal Cosmetic partner include JAKIM, sellers, buyers, logistics, IT people, payment gateway and Network of Mosque

H. Cost structure

Cost Structure defines all the costs and expenses that company will incur while operating business model because to create the good services and to make a business model work successfully. For Online Halal Cosmetic, the cost of creating and delivering the value proposition, creating revenue streams and focus on long-term customer relationships.

I. Revenue streams

This Online Halal Cosmetic will get revenue from advertisement, percent of selling product, and extra services. Next, revenue streams is the cash that company generate from each customers segments through advertisement fees.

2. Value Proposition Design Canvas (VPC)

The value proposition is one of the strategic management and execution tools to understand the customers’ needs and design the products and service according to customers’ satisfaction. There are two values proposition canvases, which are for buyer and seller. These two customer segments have different need of using the application. Therefore, values proposition canvas can help the researcher figure out what are the customers’ need and meet their satisfaction.

The VPC that is shown in Figure 10 is for seller. eHalalCosmetics4u system can help seller to sell their products in the platform of halal cosmetic in order to get more benefits. Moreover, the seller can increase their customer base worldwide because eHalalCosmetics4u system provide a medium for those sellers to promote and sell their halal cosmetic products.

Figure 10: Value Proposition Design Canvas for Seller
Besides, many customers have difficulties to find trusted halal products due to many occurrences of fake halal products. eHalal Cosmetics4u application can help customers to ensure that they will get halal products that certified by JAKIM organization as shown in Figure 11. Other gain of buyer is easy payment and fast delivery. This platform will provide them not only easy payment but also secure and confidential payment. Hence, customers can purchase trusted halal cosmetic products with secure payment and short time delivery.

3. Environment Map

Business models are designed and operated in a specific environment. For developing a good understanding of this environment results in better, more future-proof and likely more successful business models. While working with the Business Model Canvas, it is useful to elaborate more on the environment of your business. This Canvas helps you visualize the environment for your business. For Figure 12, it shows the mapping the four main forces which are key trend, industry forces, macroeconomic forces, and market forces.

Figure 11: Value Proposition Design Canvas for Buyer

Figure 12: Business model environment map
4. Strategy canvas

The comparison in term of key features of four vendors, which are Alibaba, Sephora, HalalShop and eHalal Cosmetics4u is shown in Figure 13.

![Strategy Canvas for Online Halal Cosmetics](image)

**Figure 13: Strategy Canvas**

**VIII. CONCLUSION**

In conclusion, people sometimes may have difficulties to find the real halal products especially for cosmetic products because there are many fake halal certified products selling via online. For that reason, the idea of developing platforms such as eHalalCosmetic4u is timely. eHalalCosmetic4u platform provides benefit for both buyers and seller because they can use this platform for selling and purchasing the products. The main purpose of this platform is to give a medium for sellers to sell their products and to ease buyer to find multiple halal cosmetics brands at one platform. The strategies that have been used are business model canvas, value proposition and environmental map. Thus, those ideas and strategies are useful tools for planning and developing the business successfully. For future development, the task will be moving on to the next step that is to set up the business plan in order to develop and run the business. The business plan can help the owner to clarify business idea and strategy for starting up the firm as well as propel the business to be more successful in the future.

**ACKNOWLEDGMENT**

Praise and thanks to Allah first and foremost whose blessing enabled us to accomplish this study. First of all, we wish to express our deepest appreciation to interviewers for relentless guidance, helpful suggestion, and moral encouragement to complete this task. Last but not least, a special thanks to our parents for the moral and financial support, to our lecturers for the knowledge and to our friends who always is being there to help us. Our sincerely thanks to all those whom directly or indirectly help us to complete this study.

**REFERENCES**


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In recent days, Ayurveda has started to see the glorious future. Ayurveda is originally based upon the concept of human-nature relationship. Ayurveda has believed that there is an immense similarity between body and nature. So, pharmacopoeia of ayurveda mainly show the medications prepared by combinations of different herbs and minerals. The herbal preparations and the metallic preparations.

People recognize ayurveda because of its herbal preparations. But, the herbo-mineral preparations have always seen the darker side whereas these are the inseparable part of ayurveda. But in recent years since community have raised concerns about the use of metallic preparations in the daily practice;


2) The toxicity studies of mercury and lead. (2)

“Rasashastra” and the “Rasaushadhis” are the majorly occupied part in the ayurveda. They have got great role in the ayurvedic treatment.

The main component of many Rasaushadhisis Parada (Mercury). Many preparations such as Rasaparpati, Panchamruta parpati, Sutshakhar rasa, Arogyavardhini vati etc. are the ones which are regularly used in day-to-day life.

To make the Parada safe and harmless different shodhana sanskar (3) are done over it such as shodhana, murchana, mardana etc. are sanskar done on mercury to make it useful in therapies.

A Rasasastra textinforms that Parada with attributes of a blue tinge internally and brilliant whiteness externally must be considered as pure.

Purification of Parada-

Swedana (steam), mardana (rubbing), murchana (swooning), uthapana (upliftment), bodhana (awakening of Parada), patana (sublimation of Parada), niyamna (control the moments of Prada), deepana (potentiating Parada).

For the above purification procedures herbal drugs are used.

Like about shodhana sanskar different guidelines are told by samhitakars. The amount of mercury used during the shodhana. Parada should be taken in quantity of 2000 pal (80 kg), 1000 pal (40 kg), 100 pal (4 kg), 28 pal, 10 pal, 5 pal, 1 pal (4). The preparations are to be administered orally along with specific Anupana. Anupana such as milk, honey, lukewarm water, ghee etc. are the vehicles or the Rasaushadhis are to be given with these substances. These decrease the risk of adverse reactions.

These are different forms of mercurial compounds such as elemental (or metallic) mercury, inorganic mercury compounds and organic mercury compounds. The inorganic mercurial compounds have very low rate of absorption (10-15%). While the organic mercurial compounds have high rate. Positively, the inorganic mercurial compounds are not lipid soluble hence; they cannot cross the blood brain barrier and even the placental barrier. Researchers and studies have proven the preparations to be inorganic mercurial compounds.

Rasaushadhis not only contain single ingredient but have different combinations which make the end product responsible for great therapeutic use.

Studies on preparations such as Panchamruta are concluded to treat tuberculosis, diarrhea, and abdominal diseases etc. The Anupana told is hingu, saindhava and jeeraka. Dose confirmed 2 gunja.

Lohaparapati another mercurial preparation treats the rheumatic arthritis, anemia, jaundice etc. Anupana told cold water and the dose confirmed 15 gunja.

There are number of factors which affect the effect of drug over the body. Correct usage of drug in proper dose by right route with respective Anupana told by scholars, these will definitely be beneficial. The issue as raised due to incidence of overuse, underuse or misuse of the ayurvedic medications (5).
Due to some fault herbo-mineral medications are suffering darker days. But by following standardization rules we hope traditional medicines will soon face brighter days ahead and use of mercury in ayurvedic medicines will become more easy as well as authenticated.

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References-


2) The toxicity studies of mercury and lead in Ayurvedic preparations Poal M.P Department of Life sciences university of Calicut, Kerala.

3) Rasahrudtantra chapter second- shlokas 1, 2.

4) Rasaratna sammuchyaya chapter 11- shlokas 27, 28.

5) Centre for Disease control and Prevention. Lead poisoning in pregnant women who used Ayurvedic medications from India- New York city 2011-2012.
Association between democracy and efficiency in public health services - A case study in Southeast Sulawesi Province, Indonesia

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Abstract: Democratization in developing countries has been discussed whether it could enhance efficiency and effectiveness in public administration. In Indonesia, it has been implemented in the last decades but the ability of the local governance to enhance efficiency in public health services remain questioned. This study examines the association between democracy and efficiency in health service delivery. This study employed a mixed method design and was conducted in Southeast Sulawesi Province, Indonesia. The efficiency was measured by using ratio of the cost purchased (input) and the number of services (output) in community health centres (puskesmas). Democratic variables was measured using an index that consist of components of democracy such as public participation, responsiveness, transparency and equality. Spearman’s correlation model is used to examine the association of variables. Indepth interview was conducted to explore aspects behind the association of the two objectives of administration.

This study found that there is an association between democracy and efficiency in public health services (p<0.05). This study establishes a view that the contradiction of the efficiency and the democracy in the health service is a trade-off. A range of phenomena explaining the trade-off between the two principles refers to the contradiction between democratic morality and characteristics of beaurocracy which was indicated by rivalry of individual aspiration with a trend of weak of health knowledge, on the one hand, and rational calculation with a trend of weak in commitment to democratic health service, on the other. The inquiry, also, finds that the contested individual aspiration and rational calculation is rooted on different philosophy of considerations. The contradiction of considerational based on humanistic approach and beaurocratic profesionalism to be proposed to explain the rivalry of individual aspiration and rational calculation. This study suggests that health service managements in the future keep a balance with the shift of focus a little more to the democratic side and accept a little decrease of efficiency as the cost has to pay to overcome the crisis of trust to the public services.

Key words: democracy, efficiency, primary health service, trade-off.

1. Introduction

The increasing of efficiency has become inspiration of productivity improvement in the early twentieth century for Frederick W. Taylor, Henry L. Gantt and Frank & Lillian Gillbreth which arising scientific management (Stoner and colleagues: 33-35). Several authors have argues that efficiency of maximum operation has become the objective of ‘ideal organization’ which is known as bureaucracy from Max Weber (Weber, 1946 translated 2009: 59; Robbins and Coulter, 1994: 337-338). Anitha (2007: 1) has identified that previous studies on bureaucracy have always focused on increasing of the efficiency of administrative structure to obtain service delivery effectively. The shift of paradigm from one theory to another since the era of Woodrow Wilson to the New Public Management differed in the way they looked at the problems of administration and the solution they suggested. However, the acceptance to the efficiency as the final objective of administration process cannot be understood that with the efficiency merely can be done a judgment to the performance of administrators (Denhardt dan Denhardt, 2003: 8). In contrast Dimock (1936), one of scholars, argued that mechanic efficiency is cold calculation and is not human, while success administration is warm and enthusiastic because it relates to the humanity. The two scholars added that other authors suggest that administrators and political leaders finally thinking issues in a democratic frame; such as equity, freedom, and equality, i.e. issues far stronger and harder than efficiency solely.

Nowadays, modern society wants public services forward democratic values. In Indonesia, reforms in public administration has been conducted since 2000 and it influences various aspects of governance. It seems that the intend of the people is similar to what has been long stated by scholars. According to democratic administration theory, developed by Waldo (1952, in Frederick S. Lane, 1986: 456), democratic values should be applied not only in a political event such as an election but also in the socio-economic areas, particularly in public services that it provided by government bureaucratic institutions. Ruger (2005: 303) arguesthat democratic institutions and practices may influence human development in various aspect, including population health and prosperity. He states that the absence of democracy can potentially reduce the health of people. Furthermore, Ruger pointed out that democracy and health should comprise better and newer public accountability, global cooperation in health; availability and freely information. That components should be applied in desease prevention, protection of individual rights and freedom of expression and the ability to voice the complaints.
The application of democratic values in to administration has been discussed in the literature. Authors have argued such as Blühdorn (2006: 71) reveal that ‘there is an acute awareness that in many contexts the ideals of democratic governance and efficient governance are mutually obstructive’. At the same time, Box (2001: 612) and colleagues state that The Brownlow Commission of the US President’s Committee (1937) describes that ‘efficient management in a democracy is a factor of peculiar significance’. There are components democracy, namely public participation, responsiveness, transparency and equality. Participation is one of the most frequent called values (e.g. Callahan, 2007; Winfried Steffani, 1973 quoted by Ingolfur Blühdorn, 2006: 75; Lynn M. Morgan, 2001, Barber, 1984 quoted by Robert B. Denhardt & Jannet V. Denhardt, 2000: 552; Laurence J. O’Toole, Jr., 1997). Responsiveness as the democratic values described by authors (e.g. Glass & Newall, 1992 quoted by Yang and Callahan, 2007; Richard Child quoted by Richard Box and colleagues, 2001; Robert Dahl quoted by Martin Gillens, 2005 and Wasim Al-Habil (2010). Equality is also included as the democratic value (e.g. Dwight Waldo (1986 in Frederick S. Lane, 1986), Anne Mills (1995), Frank Hendriks & Pieter Tops (1999), B. Guy Peters (2004), Ingolfur Blühdorn (2006), David M. Cutler (2002), Ebrahim Fakir (2005: 1) noted that there is tendency to make equal on the notions of democratic indicators which comprise right, responsiveness, representation, accountability, transparency, participation, and voice. Some authors pose the tensions between efficiency and democracy in different perspectives especially for democratic values. As Ingolfur Blühdorn (2006: 75) noted that: *Whilst in a broader sense, ... authors are all exploring the relationship between democracy and efficiency, they are in fact all talking about very different issues. Steffani sets the concept of efficiency against that of participation. Okun, and also Ladwig, when highlighting that “the first virtue of economy and administration is efficiency,” whilst “the first virtue of democracy is equality”, are positioning efficiency against equality.*

Early efforts in enquiry the association of efficiency-democracy in public services indicated different results. An investigation by Steven R. Beckman, John P. Formbyand W. James Smith (2003) found that equity decreasing efficiency (conflict). At the same time, David M. Cutler (2002) reported that there is trade-off between equality in health and efficiency. By contrast, a study by Mildred Warner and Amir Hefetz (2002) found that market based services increasing efficiency (sinergic), as Milena Neskova and David Guo (2009) in their study got the result that public participation leads to better organizational performance in terms of effectiveness and efficiency. This study aimed to examine the relationship between democracy and efficiency. It is carried out to answer questions: Is there any correlation between democratic services in Puskesmas and the organizational efficiency? What is the tendency of association between efficiency and democracy (sinergistic or conflict)? How could the association between the two objectives be explained? To answer the questions, this study develop enquiry with two approaches; quantitatively in determining the association

**II. Method**

This study used a mixed method design, combining both quantitative and qualitative approaches. The quantitative method was used to examine the association between democracy and efficiency. Qualitative approach, on the other hand, was used to explore the reasons for the inverse relationship between democarcy and efficiency. The efficiency was measure by using a ratio of the cost purchased by community health centre (puskesmas) in year 2013 as input, and the number of services reached by the health centers in the same year as output. The costs covering both from the national and the local budget, while number of services comprising preventive, promotive, and curative health activities; the two are calculated and compared to yield the unit cost of services which describe efficiency in the health centers. The democratic services, on the other hand, refer to the application of items of the democratic index relevant to health services. The index were developed from four democratic values (participation, responsiveness, equality, and transparency). A combination of the fourth have shaped index of democratic health service in the study location. Spearman’s correlation model is used to examine the association of variables, whilst qualitative informations are analyzed to explain phenomena behind the association of the two objectives of administration.

Urban areas of Southeast Sulawesi Province were determined as study location where they are inhabited by the urban characterized community with higher formal education, easier access to the information, and higher awareness of civil rights. All 32 community health centres (CHC) in two cities were included in this study, which are all community health centers located in Kendari and Baubau, the two cities in the province with the characteristics described above. Secondary data were collected from the health profiles, activity and budget plan, and routine reports to obtain the amount of operational costs and the number of services. Comparing the two yielded the unit costs to determine the efficiency. Interview with management of puskesmas is conducted to know number of democratic index applied. Several documents are seen to confirm the answer, such as letter inviting people representation on a meeting, name list of attending, report on public meeting, filled questionnaire of survey on service satisfaction. An in-depth interview was carried out with some informen (management of puskesmas, position holder in City and Province Health Offices, and a scholar from a health school).

**III. Results**

The results cover the amount of expense and the number of services in 32 puskesmas and calculate them to gain unit cost to describe the efficiency. In 2013, all puskesmas have three funding sources; the Health Operational Cost to finance the promotive and preventive activities, and the Community Health Assurance to fund the curative one (central government), while another one is Puskesmas Operational Cost to activate the routine activities (local government). Number of services is obtained from all program activities that comprise medical treatment, maternal and child health, family planning, immunization, nutrition, disease control,
environmental health, health education, school health, and teeth & mouth health. Democratic level is number of democratic index applied in the services. Total indexes of 31 are developed from four democratic values (public participation: 8 items, responsiveness: 9 items, transparency: 7 items, equality: 7 items).

Statistics of total costs purchased by each puskesmas and total services reached by the health institutions yield the unit cost of services, whilst number of item on index of democracy implemented describe the level of democratic health services. Tabel 1 show the statistics.

<table>
<thead>
<tr>
<th>No</th>
<th>Puskesmas</th>
<th>Unit cost of services</th>
<th>Application of Index of Democracy</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Nambo</td>
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<td>17</td>
</tr>
<tr>
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<td>13</td>
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<tr>
<td>3</td>
<td>Poaia</td>
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<tr>
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<td>Mokosau</td>
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<td>Katobengke</td>
<td>33.236</td>
<td>21</td>
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<tr>
<td>24</td>
<td>Waborobo</td>
<td>39.732</td>
<td>24</td>
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<tr>
<td>25</td>
<td>Sulua</td>
<td>37.267</td>
<td>21</td>
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<tr>
<td>26</td>
<td>Lakanbaya</td>
<td>27.270</td>
<td>22</td>
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<tr>
<td>27</td>
<td>Kadoloboko</td>
<td>26.985</td>
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<tr>
<td>28</td>
<td>Lwuto</td>
<td>33.685</td>
<td>17</td>
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<tr>
<td>29</td>
<td>Bungo</td>
<td>23.607</td>
<td>22</td>
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<tr>
<td>30</td>
<td>Kampeonaho</td>
<td>40.856</td>
<td>19</td>
</tr>
<tr>
<td>31</td>
<td>Lowulowu</td>
<td>20.250</td>
<td>20</td>
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<tr>
<td>32</td>
<td>Sorawolo</td>
<td>33.286</td>
<td>25</td>
</tr>
</tbody>
</table>

Source: DHO Kendari and Baubau, and puskesmas, 2013,

Determining 95% confidence-level, Spearman’s correlation test result in alfa 0.000, showing that null hypothesis (there is no correlation between democracy and efficiency) is rejected. The two-tailed examination demonstrate that efficiency and democracy in primary health services influences each other. The statistical test, also show the strength of association verbally since correlation is an effect size. Correlation coefficient of 0.723 and with using the guide that Evans (1996: 47) suggests states that efficiency and democracy in health services is in strong correlation. Table 2 demonstrate the results of the two tailed of Spearmans’ correlation test.

Table 2. Results of Spearmans’ Correlation Test

<table>
<thead>
<tr>
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<th>Effisieni</th>
<th>Demokrasi</th>
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<tbody>
<tr>
<td>Effisieni</td>
<td>Correlation Coefficient</td>
<td>1.000</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Demokrasi</td>
<td>Correlation Coefficient</td>
<td>.723*</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>32</td>
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</tbody>
</table>

Scattergraph on figure 1 show pattern. It demonstrates a positive correlation relationship between efficiency and democracy in the health service delivery in puskesmas with linear pattern. It demonstrates a pattern that puskesmases with higher application of democratic values tend to have higher unit costs of
health services or lower efficiency. By contrast, puskesmases with lower implementation of democratic values tend to have lower unit costs or higher efficiency.

![Figure 1. Linearity of efficiency and democracy in health service](image)

Source: Research data on puskesmas in study location, 2013,

Important points from the informenin relates to the exist conflict between the effort to reach efficiency, on the one hand, and the democracy of primary health services, on the other, describe the contradiction as well. Points of informen’s experience that describe the tension are:

1. They are insisted to response to people aspirations, whilst they should purchased the money efficiently so that the entire program can be funded and the percentage of coverage targeted in a year can be seized.
2. The informen see that the two objectives are contradict each other. Puskesmas’ services accommodate people’s wants had been felt as contradiction with the effort to minimize operational costs. They are confuse, what objective should they give priority to.
3. There are opinions that number of services funded by the health operational cost without response to people aspirations tends to be higher than the performance with democratic services because the later approach carry out democratic steps with increasing fund using.

Informen’s opinion and experience, then, illustrate aspect behind the conflict between act of determining operational costs purchased for each public health activity and the democratic health services. The main points of the statements describe some aspects refer to the existing competition of rational calculation and individual aspiration. The matter is seen from the following informen’s opinion:

1. Efficient services are based merely on suppress the cost of a puskesmas’ activity as low as possible and agree with the need, takes not any feeling except rational calculation, and refer to regulations. Differently, they consider civil rights, response to people wants, and other human values for democratic services.
2. They experience a situation in which they behave contradiction, and it’s never go easily. They determine the health activities without participation is far different with that of accept people involvement. The first method needs lower use of time and fund, while the second require higher use of steps of activities, time and money.
3. They feel that the contradictions often complicate them to choose the priority activities because there are many groups of people (housewives, non-governmental organizations, students, prominent persons, inter-sectoral personnel) with different wants and reasons.
4. According to the informen, their puskesmases reach a lower performance because the cost which is genuinely allocated on staff transport to the field for promotive and preventive activities should be changed to fund steps of democratic activities (meeting with present prominent persons, attending discussion on development planning in every village, home visit on behalf of equity and equality in health coverage, etc.).
5. Some informen tell that people they serve see the priorities in a very different way. Ten-house women group wants puskesmas allocate fund for transport and uniform for the health caders and free medication for their families, prominent persons want free medication for lower income people, students insist open forum, other civil groups demand home visit for equality in health coverage in corners of the cities in particular.

Furthermore, the informen’s statements implying their tendency to operate all their activities with the bureaucratic features as government appliances. Several characteristics of bureaucracy emerged including the bureaucratic expertise, authority, and regulation. The reasons they tend to prioritize in facing the conflict situations appear from the statements that can be shortened as follow:

1. The informenclarified that they hold public health considerations in determining the health activities. Instead of allocate operational cost to carry out public meeting for consensus or workshop for health planning with public participation, they tend to give priority to the health activities that could directly overcome the health problems their communities face. They stated that their priorities are the health interventions that contribute more significant to the reaching of maternal mortality ratio or infant mortality rate.
2. They accept public participation and they listento the people with their wants in determining the puskesmas activities, but they asked important questions while interview are conducted; What is the position of my formal authority when facing people wants in the era of the democratic public services? Why should I decide budget allocation based on people wants when rational needs analysis from my professional perspective is different with them, and I have to sign the document and take the accountability?

3. An informan who is a lecturer said that determining health activities is a routine work and it’s based on the public health expertise and regulations. In the condition of lower coverage of birth handling by health professional, higher malnutrition, and problem with diseases can be prevented by immunization, management of puskesmas will give priority to address the problems. The decisions should be based on the instruction of puskesmas operational cost. Therefore, implementing democratic services with some steps of meeting to build consensus or more responsive to many groups of people will need more time and financial resource.

IV. Discussion

The main results quantitatively and qualitatively direct the discussion to be more accurate with the opposite relation between democracy and efficiency in primary health services. The contradiction refers to the existing conflict in applying the two objectives in the health service delivery that is experienced by the managements of puskesmas. In addition, the discussion comprises interpretation on the data and information, and deepen aspects behind problematic association between applying efficiency and democracy simultaneously.

Contradiction of Democracy-efficiency in Health Services: Dilemma, Paradox, or Trade-off?

Understanding the contradiction, it is important to use terminology from Wright (1997) or terms advocated by Christopher Pollitt & Geert Bouckaert (2000) as they have been quoted by Flinders (2006: 168). They advise the difference among the terms with the possibility of precision to see the problematic relation. A Trade-off is described as a classic zero-sum game, and it is defined as a situation in which obtaining an objective, or dissapearing a problem, then it has detracted severail qualities desired on another, unavoidably. A dilemma is defined as a lose-lose situation in which is a trade-off with the situation stil negative what option is chosen. A paradox is something seen a glance as incompatible or wrong, but the fact contains a logic or a truth. A trade-off means a zero sum-game, a dilemma is a lose-lose situation, and a paradox is a positive-sum game.

The results of this study show that the association between democracy and efficiency in primary health services is a trade-off. The trend as it shown in figure 1 demonstrate that some puskesmas applying higher democratic services tend to have lower efficiency, whilst some other who implement lower democratic services tend to have higher efficiency. The gain in one of the two objectives tend to reduce the other, or in other words, the association of democracy-efficiency in health services is in zero-sum game. The data show the trade-off, and do not a dilemma in a lose-lose situation, or a paradox in a positive-sum game either. The next will discuss three of fore democratic values (participation, responsiveness and equality) since transparency is more likely not to be associated with efficiency as a result of identification of the trend between the two with a scatterplot graph.

The qualitative data strengthen the interpretation since the informen experience the situation that using financial resource efficiently to reach the coverages of puskesmas activities targeted per year with the trend of reducing level of democracieservices. They stated that they confuse what objective they should give priority to, when they are insisted to apply democratic services with responsive to people wants, accomodative to participation, and attentive to the equality of services. At the same time, puskesmas operational cost tend to result in higher number of health services without response to people aspirations. Reaching higher performance with reducing democratic practices, confusing to prioritize one of the two objectives, and ignoring one of the two objectives result in higher gain in the other, indicate the situation of zero-sum game, and not lose-lose situation, or positive-sum game.

The result seems to be parallel with Ingolfur Blühdornand Uwe Jun (2006: 7-8) who describe the contradiction that ‘democratic structures tend to be inefficient and efficiency structures tend to be undemocratic’. Its possibly that the result is a case exemple of Ingolfur Blühdorn (2006: 71) who reveal that ‘.....the ideals of democratic governance and efficient governance are mutually obstructive’. Other scholars have given attention on the relation between each democratic value and the efficiency. Denhardtand Denhardt (2006: 19-20) note the existing contradiction between desire to reach efficiency and commitment to run one of values in the democratic frame, i.e. responsiveness. The conflict seems to be mapped out when they state that while long debate about politics and administration, and also democracy and bureaucracy, public managers are encountered the conflict of efficiency and responsiveness. In addition, Blühdorn (2006: 75) explain that while Steffani see the efficiency against participation, Okun, and also Ladwig, are positioning efficiency against equality.

The finding that efficiency and democracy in primary health care tend to be conflict is consistent with David M. Cutler’s (2002: 904-905) study result in a larger scale of inquiry; i.e. hospital service. He reports that reform on health care and medical services has more than a trade-off. In the medical services, its not only equality and efficiency in the position of conflict, but both are hostages of the increase of nursing cost.

Based on discussion above, this study lift proposition 1 (minor):

‘Contradiction in the implementation of efficiency and democracy in the front line of health services is a trade-off with the pattern that the higher gain in democratic services tend to be followed by the lower reach of efficiency, or vice versa.’

Democratic and Efficient Health Services: The Rivalry of Rational Mechanic Calculation and Individual Democratic Aspiration
Continued inquiry then is focused on the reasons of the conflict to understand more the trade-off between efficiency and democracy in the primary health care. The experiences of the informen indicate that the trade-off is caused by the existing tension between professional skills of management of puskesmas, on the one front, and the freedom of the people to express their wants, on the other front. It seems that priorities of health activities in the health centers are determined by involving competition between the urge to run their public health expertise and to apply democratic services with response to the aspirations of many individuals. From their skill side, they tend to choose a priority based on the health knowledge that the activity is a closer intervention to address a health problem and allocate the fund as minimum as possible. From their urge for democratic services, they tend to respond to the wants of many individuals. The contradiction is mirrored from the statement: ‘Efficient services are based merely on suppress the cost of an activity as low as possible and agree with the need, takes not any feeling except rational calculation, and refer to regulations. Differently, we consider civil rights, response to people wants, and other human values for a democratic services’. Another informan tells that democratic services especially in accomodate people participation needs more steps of activities, time, and fund since making concensus related to determining types of puskesmas’ activities is never reached easily. They also say that it is quite different when there is not any insisting for democracy yet in the past time that they determine the health activities without people participation, so that they used fund fewer in planning puskesmas’ activities. Another statement tells that democracy complicate their position when they have to confront with many individuals or groups of people with different wants and reasons. Some informen tell an important information that genuinely the puskesmas operational cost is allocated for transport of the staff to the field for promotive and preventive health activities. However, they must allocate it to fund several steps of democratic activities such as meeting with prominent persons, attending discussion on development planning in every village, home visit on behalf of equity and equality in health coverage, etc. They argue that without giving attention to participation, responsiveness and equality in health services, they can allocate the fund directly to the field act of health activities such as services delivery in immunization, health of mother and children, improvement of nutrition, sanitation, etc. Prominent person of a group of housewife, head of village, religion, personel of government intersectors, person of student or other civil groups seems to represent individuals in democracy who want puskesmas implementing democratic services. On the other hand, management of puskesmas usual run their duties in rational bureaucratic routine with professional skills and authority based working. Tension then raise as a result from the rivalry between individual democratic aspiration and rational mechanic calculation. One important thing is that the people with hard insist for different priorities of puskesmas’ activities seems to have less health knowledge, whilst personel in management of puskesmas tend to hold their professional skills with lack of commitment to democratic services. The statement the personel of puskesmas look that ‘the people they serve see the health priorities in a very different way’ and ‘many individuals with different wants and reasons’ indicate lack of health knowledge of the people they serve. On the other hand, the personel of puskesmas who think and go back to the idea to work like in the past time before the health reform and democratic era demonstrate the tendency to carry out the services with lack of commitment to democracy. Looking at the literature knowing that authors reveal that democracy contains at least three values: firstly, individual is the main humanity value; secondly, democratic morality states that human are created equally; thirdly: democratic moraltiyemphasises wide participation among citizen. In contrast, from bureaucracyside: firstly, there is needs to unite many individual works to reach an objective; secondly, bureaucratic system is structured hierarchical; thirdly, bureaucratic organization assumed that power and authority flow from the top to the bottom instead of the opposite(Waldo, 1952 in Lane, 1986 andDenhardt&Denhardt, 2006: 19). The competition between individual democratic aspiration and the orientation to the needs of many individual that ‘beyond the capacity of single individual’ from Denhardt and Denhardt (2000) may obtain a case sample in the phenomena of the shift of determining primary health activity in puskesmas from selecting activities by a single planner to determining them through a more democratic process with listening to people proposals. Furthermore, the causal effect from the openness to the aspiration, polarization of the issue, and then difficult concensus because of interests, and culminate in increasing time and money may parallel with the scholars. An opinion from Callahan (2007: 54), for instance, in relates to deliberative and collaborative processes between government and the citizen states that the more open a process, the more polarized an issue. Human social values are called by the informen as the baseofconsiderationin accommodatingparticipation, responsiveness, denequality. Blühdorn (2006: 77-78) arguesthat all valuesrelatedto democracyarecenteredaround political subjectorSelf and thatSelffinshits self-determination and self-realization as manifestation of autonomousSelf, both individual autonomousSelf and collective autonomous Self. This study uses the words: individual democratic aspirations a representation of combination of participation, responsiveness and equality as the spirit of health services and the manifestation of individual human value and individual development. The experience of informentodetermine the health activities with involvement of a number of groups representative persons seems to be consistent with Ingolfur Blühdorn and Uwe Jun (2006: 8) that: “The more a democratic system idetrying to take into account the preferences articulated by its citizens at the inputside, the higher are the costs—monetary and nonmonetary—of the decisionmaking process, and the lower is responsiveness at the output side.” Therefore, what this study is trying to propose as proposition 2 (minor) is that: What this study propose as proposition 2 (minor) is: “The implementation of primary health services contains rivalry between individual democratic aspiration with lack of health knowledge, on the one front, and rational mechanic calculation with weak of commitment to democratic service, on the other front, culminated in the trade-off of democracy-efficiency”.
Different Administration Practice

Through the indepth interview, this study found that there is different approach between the idea to run democratic and efficient service in the world of primary health care. The informer explanations state that ‘they tend to allocate puskesmas operational costs to fund the health activities that could directly overcome the health problems their communities face instead of allocate the operational cost to carry out public meeting for consensus or workshop for health planning with public participation’. In addition, they state that ‘their priorities are the health interventions that contribute more significant to the decreasing of maternal mortality ratio and infant mortality rate’. It seems that the idea to apply democratic values in essential public service comes from the administration practice with aspirational humanistic approach, whilst the habit to run efficient principle is rooted on the administration practice with professional bureaucratic approach. The query shows indication that the rivalry of rational calculation and individual aspiration is more likely comes from different practices of administration. The former is a routine activity in the practice of bureaucratic professionalism, while the later is a relatively new trend of humanistic considerations. The clarification from the informer that ‘they tend to allocate puskesmas operational costs to fund the health activities that could directly overcome the health problems their community face instead of allocate it to carry out public meeting for consensus or workshop for health planning with public participation’, demonstrates the different practices of administrations.

In addition, the rivalry of aspiration-calculation tends to relate with the competition between the right to voice the wants of the people from the democratic side and the formal authority from the bureaucratic side. The question of the informer: ‘What is the position of my formal authority when facing people wants in the era of the democratic public services? Why should I decide budget allocation based on people wants when rational needs analysis from my professional perspective is differ with them, and I have to sign the document and take the accountability?’ indicates the existing tension between the authority from the practice of the bureaucratic professionalism and the aspiration from the practice of humanism based administration.

The results of this study show that there is significant correlation in the association of efficiency-democracy in the primary health services. A range of phenomena are found behind the troubled relationship between the effort to reach efficiency and democracy in the health services. The application of the two objectives of administration in the health institutions simultaneously result in a trade-off. A higher efficiency gain in some puskesmas tends to be followed by a lower democracy level, or vice-versa for some other puskesmas. The trade-off is more likely be explained by the existing rivalry between the individual democratic aspiration and the bureaucratic professionalism.

V. Conclusions

The results of this study show that there is significant correlation in the association of efficiency-democracy in the primary health services. A range of phenomena are found behind the troubled relationship between the effort to reach efficiency and democracy in the health services. The application of the two objectives of administration in the health institutions simultaneously result in a trade-off. A higher efficiency gain in some puskesmas tends to be followed by a lower democracy level, or vice-versa for some other puskesmas. The trade-off is more likely be explained by the existing rivalry between the individual democratic aspiration and the bureaucratic professionalism.
rational mechanic calculation that is rooted from different approach in administration practices; i.e. the humanistic aspirationalism and the bureaucratic professionalism.

We propose that administration practice in the future, in public service, and in the health service in particular, may keep the balance between the effort to reach efficiency and democracy with a little more shift to the democratic side. A little loose in efficiency should be viewed as the price must be paid to reduce the problem of trust to the government. We recommend that future study will develop the index of democracy in public service with a wider democratic values frame that can yield higher number of the item so that inferensial statistic may be applied to establish what democratic value is associated with organizational efficiency. In addition, there is need to evolve the efficiency measurein the primary health services in term of the input and the output.

V. References
Baubau City Health Service, 2013, ProfilKesehatan Kota BaubauTahun 2013, Baubau City Health Service.
Kendari City Health Service, 2013, ProfilKesehatan Kota KendariTahun 2013, Kendari City Health Service.
Kweit, M. G. danKweit, R. W., 2009, Public Involvement and Organizational Performance: Evidence from State Agencies, Prepared for Delivery at the 10th Research Conference of the Public Management Research Association Hosted by the John Glenn School of Public Affairs at the Ohio State University, October 1-3, 2009

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Feeding Habits associated with overweight and obesity amongst secondary School students in Private and Public schools in Langata Nairobi Kenya

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Abstract- Background: Obesity continues to pose major public health challenges globally. This study was conducted to determine the prevalence of overweight /obesity amongst secondary school students in private and public schools in Langata Nairobi and identify the feeding habits associated with it.

Methods: A cross-sectional descriptive survey was carried out on 292 boys and girls from both public and private secondary schools in Langata sub county Nairobi. Multistage random sampling was used to select the study participants. Data was collected using a self administered questionnaire and direct anthropometric measurements of height and weight which was used to calculate Body mass index. The World Health Organization (WHO) Age and gender specific BMI- for –age Z-scores (BAZ) was used to classify nutrition status. Data was analyzed using SPSS version 20 and WHO AnthroPlus software. Descriptive statistics were used to analyze quantitative variables. The Chi square tests were used to determine any association between selected variables such as age, gender, type of school (private or public), boarding or day, parent/guardian car(s) ownership, feeding habits such as fruit and vegetable consumption, missing breakfast, snacking, caring about portion size and overweight and obesity using 0.05 as the level of significance. For the variables that were significant at bivariate, analysis proceeded to logistic regression. Results: The prevalence of overweight and obesity was 17.8 %(16.96% among males and 20.59% among females). It was significantly higher in private (23.45%) than public schools (12.24%) with a computed p=0.047.Additionally, being a boarder p=0.004, parents’ ownership of car(s) p=0.004 and not caring about the portion size of food eaten p=0.008 were also significantly associated with overweight and obesity. Conclusion: The prevalence of overweight and obesity in this study is high especially among girls and should be of public health concern to policy planners. Recommendation: The government should consider increasing time for physical education in schools and introducing some levy on junk food in addition to a school health and fitness programme involving parents.

Index Terms- Adolescents, Body Mass Index, Kenya, Obesity, Overweight

I. INTRODUCTION

Worldwide, obesity prevalence has nearly doubled between 1980-2014. According to the World Health Organization (WHO 2016), more than 1.9 billion adults 18 years and older were overweight. Out of these 600 million were obese. In 2014, approximately 35% of adults 18yrs and above were overweight (WHO,2016) WHO defines overweight and obesity (OWO) as abnormal or excessive fat accumulation that may impair health. Overweight and obesity in adults is classified using Body mass Index (BMI) which is a simple index of weight for height. It is defined as a person’s weight in Kilograms divided by the square of his height in meters (kg/m²). A BMI greater than or equal to 25 but less than 30 is considered overweight while a BMI greater than or equal to 30is said to be obesity (WHO, 2011). With research strongly associating parental obesity as a risk factor for childhood obesity, this may be a pointer to increasing rates in school going children. In a study amongst 9-14 year olds, 29% children in private and 11.5% of those in public schools were found to be OWO (Kyallo et al., 2013). Adamo et al., (2010) found that 16.7% of the girls and 6.8% of the boys in urban areas in Kenya were obese/ overweight. Though the process of overweight and obesity (OWO) development is not well understood, it is believed to have manifold causes. It is believed to be caused due to an imbalance between energy intake and expenditure where the intake supersedes expenditure (Kyallol et al., 2003). Several studies have associated socio economic status with OWO (Sztainer et al., 2002; Adesina et al., 2012; Kyallol et al., 2013). Although OWO has been shown to be more prevalent in subpopulations with low SES in the developed countries the reverse is true in the developing countries (Kyallol et al., 2013). KDHS 2008/2009 reported a higher prevalence among women of high SES (KNBS et al., 2010). Overweight and obesity are the fifth leading risk for global deaths (WHO, 2011). WHO estimates that at least 2.8 million adults die each year as a result of being overweight /obese. In addition, 44% of the diabetes burden, 23% of the ischemic heart disease burden and between 7% and 41% of certain cancer burdens are attributable to overweight and obesity (WHO, 2011). A recent study by Katz et al., 2013 found that obese adolescents were at greater risk of sensori neural hearing loss.

The feeding habits that one acquires during adolescence greatly contribute to obesity (Sztainer et al., 2002). Hanley et al.,
(2000) found that it is not only the amount of food intake but also its dietary composition and quality are factors that determine the prevalence of overweight/obesity. This is because dietary patterns, particularly among children and adolescents, which have been marked by low consumption of fruits and vegetables and an increased consumption of sandwich biscuits, snacks, sweets, and sodas, have often been associated with the overweight/obesity in this range. Another study by Corder et al., (2011) also revealed that frequent breakfast consumers had a higher total intake of energy but had lesser chances of being overweight than their counterparts who skip breakfast. Studies have found an association between teenage overweight and adulthood obesity (Domingo et al., 2007) especially among girls (Murage, 2013) a risk factor for early deaths, cardiovascular diseases, hypertension, some types of cancers, asthma, and obstetric problems in adulthood. Most linked to schooling are stigmatization (Pearce et al., 2002; Bray, 2004) and hearing loss which may affect learning (Katz et al., 2013).

Hence, this study sought to determine the prevalence of overweight and obesity amongst high school students in public and private schools and to identify the feeding factors associated with it as a follow up on other studies (Kyallo et al., 2013). Most importantly it sought to generate evidence that will be brought to the attention of the concerned parties i.e. parents, schools, policy makers such as the Ministry of Education (MoEST), Ministry of Health (MOH) so as to take action towards preventing it.

II. MATERIALS AND METHODS

Study design, setting, population

This cross sectional descriptive survey was carried out over a period of two weeks on 14-18 year old secondary school boys and girls in Langata sub county, Nairobi Kenya. Langata is a residential area in Nairobi which comprises of areas such as Karen inhabited by people of high socioeconomic class and Kibra, a slum. In essence, opulence and poverty thrive within Langata. Like most of Nairobi city Langata is well served with hotels, restaurants such as Ken chic, java and a good road network, modern congested housing hence a sedentary lifestyle is unavoidable.

Sample size, Ethical approval, inclusion/exclusion criteria.

Ethical approval was sought from Institutional Research and Ethics Committee (IERC) of Moi University, and study approval from National Commission for Science, Technology and Innovation (NACOSTI). Based on a previous study by Kyallo et al., 2013, Varkessier’s et al., 2003 formulae \( n = p(1-p) + p^2(1-p) \) was used to select 292 boys and girls to participate in the study using Multistage sampling technique since this was a comparative study. Students suffering from any known illnesses such as heart disease, asthma, sickle cell were also excluded from the study (Adesina et al., 2012). The school Principals and parents signed consent forms whereas students signed assent forms having been told that participation was purely on voluntary basis.

Data Collection procedure

Data was collected using a piloted self administered questionnaire in which the students were asked to fill in their socio demographics such as age, gender (Mesas et al., 2012) type of school (private/public, boarding/day) (Kyallo et al., 2013), type of residence, mothers level of education, car ownership by parents/guardians, amount of pocket money given per month, qualification for Constituency development fund for school fees subsidy. They also self reported on their feeding habits such as frequency of snacking (Goldfield et al., 2011), fruits and vegetable consumption (Mello et al., 2010), frequency of skipping breakfast (Corder et al., 2011) mindful eating, (Mesas et al., 2012) consumption of soda and other sweetened drinks (Malik et al., 2006)

Anthropometric measurements of weight and height were also taken by two trained research assistants (Male and Female) and used to calculate BMI. The students were lightly dressed in a private room (Kyallo et al., 2013) They used a Ramtons scale Model RM 285, Serial no 03410255 for measuring weight and a stadiometer for measuring height. Weight was taken without shoes, lightly dressed and recorded to the nearest 0.1kg. Height was taken without shoes feet together and arms by the sides looking straight ahead and the head rest pressed firmly on the head. Both measurements were taken twice and the average recorded. For avoidance of inter observer bias, one research assistant took the measurements while the other recorded them. (Adesina et al., 2012).

Nutrition Status reference Standard:

Body Mass Index was then calculated as Weight in kg/ divided by height in meters squared. BMI for age Z scores were then computed using WHO AnthroPlus software. Classification of overweight and obesity was then determined using WHO gender specific BMI-for-age- Z scores (BAZ) for children 5-19 yrs as follows. Underweight= BAZ ≤−2SD, Normal=−2SD<BAZ≤1SD, Overweight= +1SD<BAZ≤+2SD, Obese=BAZ > +2SD, Overweight/obese= BAZ>+1SD (Kyallo et al., 2013).

Data Analysis: Data was analyzed using SPSS version 20 and WHO AnthroPlus software. Descriptive statistics were used to analyze quantitative variables such as age, BMI, Weight, height. The chi-square tests were used to determine any association between selected variables such as age, gender, type of School (private or public), boarding or day, feeding habits such as snacking, fruit and vegetable consumption, missing breakfast and overweight and/obesity using 0.05 as the level of significance. For the variables that were significant at bivariate, analysis proceeded to Logistic regression.

III. RESULTS

Demographic Characteristics of the respondents

A total of 292 participants took part in the study. The response rate was 100%. There were 224 boys and 68 girls aged 14-18yrs from both public and private, boarding and day schools across all classes from form 1-4. The majority of female students (45) were from public schools whereas only 23 were from private schools. Most of the boarding students (145) were from private schools and only 73 were from public schools. Their mean age of all the students was 16.08yrs. (Table 1)

Anthropometric characteristics by gender and school type

On average the girls had a higher BMI (22.30 SD 4.69) than the boys (21.61 SD4.31). Comparatively the average BMI for
students in private schools (22.73) was higher than in public (21.36). (Table 2)

Nutrition status of students by school type and gender

According to table 3 overweight and obesity was higher in private (23.45%) than public (12.24%) schools. Overweight and obesity among boys in private schools (23%), was 2.3 times higher than among boys in public schools (9.8%). Girls in private schools were 1.5 times likely to be overweight or obese (26.1%) than their counterparts in public schools (17.8%)

| Table 1: Demographic characteristics of the students by type of school (n=292) |
|-------------------|----------------|----------------|
| Demographic characteristics of the students | n (N = 292) | Percentage | Public n (%) | Private n (%) |
| Gender: Male | 224 | 76.7 | 102 (45.5) | 122 (54.5) |
| Female | 68 | 23.3 | 45 (66.2) | 23 (33.8) |
| Type of School: Private | 145 | 49.7 |
| Public | 147 | 50.3 |
| Age: 14 | 46 | 15.8 | 15 (32.6) | 31 (67.4) |
| 15 | 51 | 17.5 | 22 (43.1) | 29 (56.7) |
| 16 | 71 | 24.3 | 33 (46.5) | 38 (53.5) |
| 17 | 82 | 28.1 | 48 (58.5) | 34 (41.5) |
| 18 | 42 | 14.4 | 29 (69.0) | 13 (31.0) |
| Known Health Conditions: Yes | 0 | 0 | 0 (0) | 0 (0) |
| No | 292 | 100 | 147 (50.3) | 145 (49.7) |
| Class: Form 1 | 80 | 27.4 | 41 (51.2) | 39 (48.8) |
| Form 2 | 78 | 26.7 | 36 (46.2) | 42 (53.8) |
| Form 3 | 73 | 25 | 41 (56.2) | 32 (43.8) |
| Form 4 | 61 | 20.9 | 29 (47.5) | 32 (52.5) |
| Boarder/ Day Scholar | | | |
| Boarder | 218 | 74.7 | 73 (33.5) | 145 (66.5) |
| Day Scholar | 74 | 25.3 | 74 (100) | 0 (0) |

| Table 2 Anthropometric characteristics by gender and school type |
|-------------------|-------------------|-------------------|-------------------|
| | All (Mean, SD) | Private Schools (Mean, SD) | Public Schools (Mean, SD) |
| | Male n=224 | Female n =68 | Male n=122 | Female n=23 | Male n=102 | Female n=45 |
| Weight (Kg) | 60.49 (11.60) | 57.24 (9.18) | 61.82 (12.39) | 55.55 (8.44) | 58.89 (10.43) | 58.10 (9.51) |
| Height (m) | 1.68 (0.1) | 1.61 (0.10) | 1.67 (0.10) | 1.57 (0.14) | 1.68 (0.09) | 1.63 (0.07) |
| Mean BMI | 21.61 (4.31) | 22.30 (4.69) | 22.20 (4.68) | 23.26 (6.35) | 20.90 (3.72) | 21.82 (3.55) |
Socio demographic characteristics of OWO students and the normal weight students

There was a significant difference in OWO rates based on the type of school (p=0.047), being a boarder or a day-scholar (p=0.0020) and ownership of car(s) by parents (p=0.028). However within the schools there was no significant difference in overweight and obesity rates between boys and girls (p=>0.05) (Table 3). The average monthly Pocket money for the OWO students was higher (Ksh.1, 586.4) than the average monthly pocket money for the normal weight students (Ksh.1, 111.5) across all ages. 16yrs had the highest proportion of the normal weight students (92.96%) and only (7.04%) were overweight and obese. Prevalence of OWO had a positive association with class, gradually increasing from form 1-4 (f1:15%, f2: 17.95%, f3: 19.18%, and f4: 19.67%). (Table 4)

Table 3: Nutrition status of students by school type and gender

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Private Schools</th>
<th>Public Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Underweight</td>
<td>2.8</td>
<td>3.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Normal</td>
<td>73.8</td>
<td>73.8</td>
<td>83.0</td>
</tr>
<tr>
<td>Overweight</td>
<td>10.3</td>
<td>10.7</td>
<td>7.5</td>
</tr>
<tr>
<td>Obese</td>
<td>13.1</td>
<td>12.3</td>
<td>4.8</td>
</tr>
<tr>
<td>Overweight &amp; Obese</td>
<td>23.4</td>
<td>23.0</td>
<td>12.3</td>
</tr>
</tbody>
</table>

PREVALENCE OF OVERWEIGHT/OBESITY

17.8  23.45  12.24

Table 4: Comparison of demographic characteristics of the normal weight and OWO students

<table>
<thead>
<tr>
<th>Socio-Demographic Factors</th>
<th>Normal weight (%)</th>
<th>Overweight &amp; Obese (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of School:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>76.55</td>
<td>23.45</td>
<td>0.047 *</td>
</tr>
<tr>
<td>Public</td>
<td>87.76</td>
<td>12.24</td>
<td></td>
</tr>
<tr>
<td>Boarder/Day Scholar:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boarder</td>
<td>78.44</td>
<td>21.56</td>
<td>0.020*</td>
</tr>
<tr>
<td>Day Scholars</td>
<td>93.24</td>
<td>6.76</td>
<td></td>
</tr>
<tr>
<td>Mother’s Level of Education:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not finish high school</td>
<td>85.29</td>
<td>14.71</td>
<td>0.288</td>
</tr>
<tr>
<td>Diploma</td>
<td>90.00</td>
<td>10.00</td>
<td></td>
</tr>
<tr>
<td>Degree</td>
<td>77.27</td>
<td>22.73</td>
<td></td>
</tr>
<tr>
<td>Age:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>78.26</td>
<td>21.74</td>
<td>0.065</td>
</tr>
<tr>
<td>15</td>
<td>75.55</td>
<td>27.45</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>92.96</td>
<td>7.04</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>81.70</td>
<td>18.29</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>80.95</td>
<td>19.05</td>
<td></td>
</tr>
<tr>
<td>Gender:</td>
<td></td>
<td></td>
<td>0.653</td>
</tr>
</tbody>
</table>
Feeding habits associated with overweight and obesity.

Genetics predisposes one to OWO, however environmental factors such as poor feeding habits greatly influence overweight and obesity.

Three-day feeding was used as the yardstick in this study and information on the weekly feeding habits was collected whereas 2 meals was the yardstick for the daily feeding habits. The study revealed that 41.2% of the students who cared about the portion size of food they ate were overweight/obese compared to 58.8% of those who did not care about the portion size of food they ate. This habit together with how often a student ate snacks after or between meals per week as well as how often they drank water before meals in a day had p-values of less than 0.05, (Table 5.) and their analysis proceeded to the logistic regression level.

Table 5: Feeding habits of the normal weight vs. OWO students

<table>
<thead>
<tr>
<th>Feeding Habit</th>
<th>Normal weight (%)</th>
<th>Overweight &amp; Obese (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missed breakfast in a week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 3 days</td>
<td>81.51</td>
<td>18.49</td>
<td>0.974</td>
</tr>
<tr>
<td>3 or more days</td>
<td>88.89</td>
<td>11.11</td>
<td></td>
</tr>
<tr>
<td>Snacks consumption in a week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 3 days</td>
<td>78.91</td>
<td>21.09</td>
<td>0.019 *</td>
</tr>
<tr>
<td>3 or more days</td>
<td>84.76</td>
<td>15.24</td>
<td></td>
</tr>
<tr>
<td>Daily 3 servings of fruits in a week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 3 days</td>
<td>89.02</td>
<td>10.98</td>
<td>0.203</td>
</tr>
<tr>
<td>3 or more days</td>
<td>79.52</td>
<td>20.48</td>
<td></td>
</tr>
<tr>
<td>Daily 2 servings of vegetables in a week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 3 days</td>
<td>88.95</td>
<td>11.05</td>
<td>0.124</td>
</tr>
<tr>
<td>3 or more days</td>
<td>71.17</td>
<td>28.83</td>
<td></td>
</tr>
<tr>
<td>Sweetened juices consumption in a week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 3 days</td>
<td>74.34</td>
<td>25.66</td>
<td>0.074</td>
</tr>
<tr>
<td>3 or more days</td>
<td>87.15</td>
<td>12.85</td>
<td></td>
</tr>
<tr>
<td>Control of amount of food eaten in day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 3 times</td>
<td>90.48</td>
<td>9.52</td>
<td>0.169</td>
</tr>
<tr>
<td>3 or more times</td>
<td>79.91</td>
<td>20.09</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05, statistically significant
Predictors of overweight and obesity

The Chi-square Tests were used to determine if there was any significance between the variables and OWO status. The 7 variables that were found to have an association with OWO status at bivariate level were included in the logistic regression analysis. Logistic regression analysis was employed to determine which variables could best predict OWO status.

The only demographic predictor that made a significant difference in rates of OWO was being a boarder or a day scholar. This shows that chances of a student being OWO were affected by whether he/she was a boarder or a day scholar. Boarders were 2.34 times more likely to be OWO compared to day scholars (OR 2.34, C.I: 0.88-6.23). The type of school the student attended did not make any significant difference in OWO rates (sig. 0.809 > 0.05). Parents’ car(s) ownership was the only socio-economic predictor that made a significant difference in OWO rates (sig. 0.004). The chances of being OWO were 2.36 times higher among students whose parents owned car(s) compared to those whose parents did not own a car (OR 2.358, C.I: 1.35-4.226). The analysis further revealed that caring about portion size of food eaten was the only feeding habit predictor that made a significant difference in OWO rates (sig. 0.008). The chances of being OWO were 2.31 times higher amongst those who did not care about the portion size of food they ate compared to those who cared (OR 2.308, C.I: 1.247-4.272).

IV. DISCUSSION

Prevalence of OWO among secondary school students.

The prevalence of OWO in this study was found to be 17.8% and was significantly higher in private than public schools suggesting a positive association with socio economic status. This study assumed that private schools serve those from high socio economic status whereas public schools serve those from low socio economic status since the school fees is low at Ksh 53000 (MoEST, 2014) due to government subsidy. This finding is similar to many studies (Adesina et al., 2012, Field et al., 2013). H. T. Le et al., 2013, Ene-obong et al., 2012). Additionally they could be walking to school which helps in shedding off some weight. Food insecurity has also been found to have an association with overweight among low income families especially among women. A possible explanation for this could be that high calorific foods are cheaper than fruits, vegetables, lean meats and fiber rich foods (Mello et al., 2010).

However these findings are different from (Dehghan et al., 2005) where the prevalence of OWO among children in the US was almost twice the prevalence in this study at 36% (25% overweight and 11% obese). This is not surprising because comparatively US is a stronger economy than Kenya given that studies have found a positive association between OWO and high SES. After finding a higher prevalence among girls, Adesina et al., (2012) concluded that this could be because adolescent girls usually have an increase in fat mass as opposed to boys whose fat mass stabilizes and instead increase their fat free mass. Car(s) ownership was a significant factor (p=0.028) to OWO. The odds of being OWO were 2.3 times higher amongst students whose parents own car(s) compared to those whose parents didn’t own car(s). For the students whose parents owned cars, 22.98% were OWO compared to just 11.45% of those whose parents didn't own car(s). In Kenya currently, owning a car(s) is a symbol of high SES. The fact that it had a positive association with OWO in this study is a pointer to the positive association between OWO and SES. Being in boarding or day schooling made a significant difference in OWO rates (p=0.020) as the odds of being OWO was 2.3 times higher amongst boarders compared to day scholars. Therefore it is conclusive that being a day scholar had a protective effect on the students. This is not surprising because there were no private day schools in the study as all private schools were boarding schools whereas in the public schools category there were day scholars. This again supports the association between OWO and SES. The day scholars may also be accessing healthier foods prepared at home (Adesina et al., 2012). Additionally they could be walking to school which helps in shedding off some weight. Food insecurity has also been found to have an association with overweight among low income families especially among women. A possible explanation for this could be that high calorific foods are cheaper than fruits, vegetables, lean meats and fiber rich foods (Mello et al., 2010).

Feeding habits associated with overweight and obesity

The frequency of snacking between meals made a significant difference in OWO rates in this study (p=0.019) similar to (Marin-Guerrero et al., 2008) and contrary to other studies (Adesina et al., 2012, Field et al., 2004, Phillips et al., 2004). However the study by Field et al., (2004) had limitations as the sample size was not a random representative of all the adolescents of the US. Snacks may cause overweight threefold. First and foremost most snacks are fatty and therefore laden with

<table>
<thead>
<tr>
<th>Consumption of water before meals in a day</th>
<th>Less than 3 times</th>
<th>3 or more times</th>
<th>0.049*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adding blue band or margarine to cooked food in a day</td>
<td>Less than 3 times</td>
<td>3 or more times</td>
<td>0.2000</td>
</tr>
<tr>
<td>Caring about portion size</td>
<td>Yes</td>
<td>No</td>
<td>0.002*</td>
</tr>
</tbody>
</table>

* p<0.05, statistically significant
calories, secondly they are eaten together with but not replacing meals and lastly sweet snacks may promote hunger and appetite and thus promote eating. Caring about portion size of food to eat had a significant association with OWO similar to (Mesas et al., 2012). When OWO students were compared to their normal weight counterparts, only 41.2% p=0.002 reported caring about the amount of food they ate and a majority (58.8%) reported not caring at all in comparison to the normal weight students who 61.8% cared about how much they ate and only 38.2% did not care. However the author could not get similar studies on this, but given that majority of the students ate a lot of snacks across all ages as discussed earlier, If they ate them in large quantities then OWO was inevitable since snacking may cause OWO as stated earlier by Field et al., (2004). It is evident that being careful about portion size of food to eat can be a useful weight control measure. Small reductions in amount of food eaten can be a useful strategy to reduce energy intake. (Lewis et al., 2015). Corder et al., (2011) also found that frequent breakfast consumers had lesser chances of becoming overweight. He therefore concluded that possibly skipping breakfast may lead to apathy and lethargy which may in turn lead to a reduction in Physical activity and hence enhance weight gain. However the teenagers’ poor feeding could be fueled by the school and home environments because when all students were asked why they didn’t eat 3 servings of fruits and 2 servings of vegetables per day, a majority (74.1%) reported that the fruits were not available at school/home daily whereas again 52.8% reported that the vegetables were not available at home/school daily.

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COMPETING INTERESTS

The authors declare that they have no competing interests

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*Authors’ contributions
CR, JN, and FW were all involved in all aspects in the development of this Manuscript.
CREATING ORGANIZATIONAL AMBIDEXTERITY INFLUENCED BY ENTREPRENEURIAL COMPETENCIES, AND EXTERNAL ENVIRONMENTAL DYNAMISM AND ITS IMPACT TOWARDS BUSINESS PERFORMANCE THROUGH SUSTAINABLE COMPETITIVE ADVANTAGE

(STUDY ON LOGISTICS SERVICES INDUSTRY IN DKI JAKARTA)

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Yudi Aziz

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Abstract: The objective of this research was to know the influence of Entrepreneurial Competencies and External Environmental Dynamism, to Organizational Ambidexterity and its implication on Sustainable Competitive Advantage and impact on Business Performance. The research method was quantitative through survey research approached by causal comparative. The sample technique was probability sample with sampling multistage methods in number of respondents was 180 of logistics service companies in Jakarta, Indonesia. The analysis technique used Structural Equation Modeling (SEM) by software Lisrel 9.1. The result of this research showed the relations and strong impact between the whole variables.

Keywords: Organizational Ambidexterity, Entrepreneurial Competencies, External Environmental Dynamism, Business Performance, Sustainable Competitive Advantage

1. INTRODUCTION

The score of Logistics Performance Index (LPI) that released by World Bank in 2016, set an unfavourable position for Indonesia compared to Southeast Asia countries. Based on LPI, Indonesia was on position to 63 of 160 surveyed countries by scoring 2.98. This position was down compared to last 2014, which it was to 53 with scoring 3.08. Indonesia position is under Singapore (rank 5, score 4.14), Malaysia (rank 32, score 3.43), Thailand (rank 45, score 3.26). LPI is logistic performance indicator of country, which scored by aspects of customs efficiency process, infrastructure quality related to transportation and trade, international shipment, logistic competency, the ability of tracking and tracing, and the timeliness of delivery.

In line with achievement of LPI above, it required improvement each logistic in Indonesia to increase the competitiveness of logistic performance to the better level. The improvement referred is not only relying on Government, but also the whole operators responsibility in logistic service and related associations. As known Indonesia is the largest archipelago country in the world and therefore needs the special treatment to be improved, can not be equated to others countries in term standardized on logistics managerial processes.

According to Gopal R. (2016), Indonesia has the huge potential market in transportation and logistic. In 2015, the market value was estimated to reach US$ 165 billion, which US$ 44 billion of the transportation and US$ 121 billion of the industry logistic activities. The predicted of transportation and logistics industries up to 2020, will
grow up to 15.4%. The huge market potential and business opportunities in one hand, and the problems that overarching in another hand causing some domestic company can not utilize the potential optimally. On other hand, the domestic company failing one by one due to the tight competition, especially caused by pressure from foreign logistic service companies.

Viewed from the business characteristics side, the business performance of logistics service company is not only influenced by external aspect or macro, but also highly dependent upon the strength competency of managerial or can be said on the entrepreneurial competencies strength. The contribution of managerial or entrepreneurial competencies in the logistic service company is very decisive, because many business aspects are determined by management strategy, commitment, managerial concept, captured opportunity ability, good management and leadership, interweave relationships ability, personal superior competency, and business technical skill, which are all called entrepreneurship competencies.

The logistic service companies tend to less innovative, because always run the business from time to time, in other words mostly of these kinds of company focus in the exploit. Company must to exploit the efficiency, process improvement, including innovation. However, the innovation is usually only internal scope, which forgets new innovations outside of the habit of the regular businesses. Although there were able to repeat the successful back but after through the issue over and over again, in other word the company was too busy exploiting. Once the business becomes saturated, company is starting to consider the new one by exploration but it’s too late. In this context appears ambidextrous organization concept, the organization concept that running an exploit and explore methods side by side.

The increase of the logistic services companies from West and Asia region to do activities in Indonesia, demanding these logistic service companies to maintain and improve the sustainable competitive advantage (SCA). This SCA is a success key to exist and keep creating a superior business performance.

2. Theoritical Background

This research intend to develop the grand theoretical model “Strategic moved to achieve business performance through Organization Ambidexterity mediation and Sustainable Competitive Advantage, and the role of exogenous variable Entrepreneurial Competencies and External Environmental Dynamism”. To develop Grand Theoretical Model needs some theories that explain the variables relation, such as Entrepreneurial Competencies, External Environmental Dynamism, Organizational Ambidexterity, Sustainable Competitive Advantage, and outcome variable that is Business Performance.

Strategic Management was used as a basic theory, which related to Huang and Lee (2012) theories:

“A review of strategic management literature indicates that two important schools of thought have emerged that seek to explain the competitive advantage of a firm. Resource-based view theory focuses on firm effects, whereas industrial organization literature emphasizes industry effects as critical determinants of competitive advantage and superior performance”.

Some of competitive advantage concepts delivered by experts would be discussed below.

According to

Porter (1993:2)

Competitive advantage grows fundamentally out of value a firm is able to create for its buyers that exceeds the firm’s cost of creating it.

Porter (1993:4)

Competitive Advantage is at the heart of a firm’s performance in competitive markets” and goes on to say that purpose of his book on the subject is to show “how a firm can actually create and sustain a
competitive advantage in an industry—how it can implement the broad generic strategies.” Thus, competitive advantage means having low costs, differentiation advantage, or a successful focus strategy. In addition, Porter argues that “competitive advantage grows fundamentally out of value a firm is able to create for its buyers that exceeds the firm’s cost of creating it.

David (2013:38)

Anything that a firm does especially well compared to rival firms. When a firm can do something that rival firms cannot do, or owns something that rival firms desire, that can represent a competitive advantage.

Hitt et al. (2012:5)

A sustained or sustainable competitive advantage occurs when a firm implements a value-creating strategy of which other companies are unable to duplicate the benefits or find it too costly to imitate.

Based on the definitions above, generally the excellence competitiveness is a company excellence, which can work better and more successful compared others companies in the same industry.

According to Foroughi et al. (2015) the Organizational Performance is an accumulated outcome of the whole process and organization work activities. It is a complicated but important concept, manager needs to understand the contributed factors to high organization performance. More than that, they intend to success in high performance, which organization, working-unit or working group achieve the highest performance, no matter what the mission are, strategies, or target is being chased. Further than that Kaplan and Norton (1997) said that the role of performance assessment in helping organization member to manage the value chain.

In 1976 Duncan (in Bodwell, 2011) was the pioneer who introduced the term of Organizational Ambidexterity (OA). Then before March 1991 issued a seminar paper about OA, and ever since OA become a popular concept until today. In its development, the OA conceptual papers based on Organization Learning (OL), Strategic Management (SM) that are description of the March’s framework that had been written by others experts (Bratnicka 2014, Good and Michel 2013, O’Reilly III and Tushman 2013, Zacher and Wilden 2014).

Based on Good and Michel (2013), Organization Ambidexterity (OA) is a company ability to explore and exploit simultaneously. Exploration was defined as a knowledge to search, novelty, experimentation, innovation, radical changes and new product creation, process, and services Exploitation was defined as a knowledge to continuous improvement, modification, improvement, and additional product changes, process and services (O’Reilly III and Tushman, 2013).

Some important definition had been presented by experts, which become a basic entrepreneurship thought today (Strauss, 2014) are proposed by:

1) Joseph Schumpeter: “entrepreneur are innovators who use a process of shattering the status quo of the existing products and services, to set up new products, new services.”

2) Peter Drucker: “An entrepreneur searches for change, responds to it and exploits opportunities. Innovation is a specific tool of an entrepreneur hence and effective entrepreneur converts a source into a resource.”

3) Howard Stevenson: “Entrepreneurship is the pursuit of opportunity without regard to resources currently controlled.”

Based on Al Mamun et al (2016), a critical analysis that done on previous model, entrepreneur competency was finally earned eight significant competences, which was recommended for further investigation that include: strategic, commitment, conceptual, opportunity, organizing and leading, relationship, personal, and technical.
Organization strategic was determined mostly by organization environment. That is why; the relationship between organization and its environment is one of the most important topics of strategic management. Most of the research concentrated in uncertainty environment that appears becomes the main limitations in organization activities. This theory was based on argument that the organization sustainability depends on effective and efficient performances. The highest performance could be achieved if the organization responds to environment demands in the right way. Therefore, the research with dependence resources perspective is become important to consider environment dimension, with organization operated. Internal and external organization condition determines characteristic composition as a consequence is an organization performance. External Environment Dynamism has to be faced and taken seriously by the proper and fast strategy (Hoogh et al. 2004).

Based on the studied theory, previous researchs, and thinking framework, which had been discussed deeply in previous section, it can be formulated the links of conceptual model among Entrepreneurial Competencies, External Environmental Dynamism, Organizational Ambidexterity, Sustainable Competitive Advantage, and Business Performance in the thinking framework / research paradigm match to Figure 2.1:

![Figure 1. Research Framework](image)

**Hypotheses**

Based on description in theory, research framework, and research variable entaglement paradigm, hypotheses can be structured in this research:

Hypothesis 1: Entrepreneurial Competencies and External Environmental Dynamism gives impact to Organizational Ambidexterity whether partial and simultaneous.

Hypothesis 2: Entrepreneurial Competencies gives influence to Sustainable Competitive Advantage.

Hypothesis 3: External Environmental Dynamism gives effecting to Sustainable Competitive Advantage.

Hypothesis 4: Organizational Ambidexterity gives influences to Sustainable Competitive Advantage.

Hypothesis 5: Sustainable Competitive Advantage gives impact to Business Performance.

Hypothesis 6: Entrepreneurial Competencies gives effecting to Business Performance.

Hypothesis 7: External Environmental Dynamism gives impact to Business Performance.

3. **Method**
The research methodology was quantitative with description and verificative research. The total sample of the research was about 180 companies that consist of five big companies in entered financial markets and 175 small and medium-sized companies in service logistic. Structural Equation Modeling (SEM) was used as an analysis technique in this research in AMOS Version 22.0/Amos Graph.

Entrepreneurial Competencies Variable includes dimensions of:
1) Opportunity Competency
2) Relationship Competency
3) Conceptual Competency
4) Organizing and Leading Competency
5) Strategic Competency
6) Commitment Competency
7) Personal Competency
8) Technical Competency.

Meanwhile, External Environmental Dynamism includes dimensions of:
1) Competitive Intensity
2) Government Regulation
3) Infrastructure Support
4) Macro Economic Indicator.

Furthermore, Organizational Ambidexterity Variable includes dimensions of:
1) Exploration
2) Exploitation.

As to Sustainable Competitive Advantage Variable includes dimension of:
1) Price/Cost Advantage,
2) Service Quality,
3) Service Innovation,
4) Market Response, and
5) Company Reputation.

Meanwhile, Business Performance includes dimensions:
1) Financial Perspective
2) Customer Perspective
3) Internal Business Process Perspective
4) Learning and Growth Perspective

In studying the impact of variables of Entrepreneurial Competencies, External Environmental Dynamism, Organizational Ambidexterity and Sustainable Competitive toward Business Performance used regression analysis by Structural Equation Modeling (SEM).

Meanwhile, in screening the data, this study use Validity and Reliability Test. In this, Validity Test done by analyzing the Average Variance Extracted (AVE) by looking at the average of variance extracted between indicators. As to the criteria used is when the AVE > 0.5 the scale used in this study is valid.

Furthermore, Reliability test done by analyzing the Construct Reliability (CR) by looking at the consistence of data. As to the criteria used is when the Construct Reliability > 0.7 the scale used in this study is reliable.
4. Discussion

From total research sample of 180 companies, there are 89.5% company did not have a foreign stock participation and only 10.5% companies has. Furthermore 91.65% company has 1-10 domestic branches, 5.6% has 11-20 domestic branches and 2.8% has 21-30 domestic branches. The average of total company assets is Rp. 441.364.537.921, the average of total company income is Rp. 332.922.951.934, and the average of total company net profit is Rp. 27.696.459.895, and has human resources (employees) about 185 people and 65 cutomer generally.

In this study, the used scale has been tested by validity and reliability test and the result seen in the table below:

**Table 1. Result of Validity and Reliability Test**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Indicator</th>
<th>$\lambda$</th>
<th>$\lambda^2$</th>
<th>e</th>
<th>CR</th>
<th>AVE</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>KK</td>
<td>KK1</td>
<td>0.726</td>
<td>0.527</td>
<td>0.474</td>
<td>0.948</td>
<td>0.696</td>
<td>Reliabel &amp; Valid</td>
</tr>
<tr>
<td></td>
<td>KK2</td>
<td>0.731</td>
<td>0.534</td>
<td>0.465</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KK3</td>
<td>0.875</td>
<td>0.766</td>
<td>0.235</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KK4</td>
<td>0.817</td>
<td>0.667</td>
<td>0.332</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KK5</td>
<td>0.880</td>
<td>0.774</td>
<td>0.226</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KK6</td>
<td>0.911</td>
<td>0.830</td>
<td>0.170</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KK7</td>
<td>0.852</td>
<td>0.726</td>
<td>0.273</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KK8</td>
<td>0.861</td>
<td>0.741</td>
<td>0.258</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DLE</td>
<td>DLE1</td>
<td>0.915</td>
<td>0.837</td>
<td>0.162</td>
<td>0.884</td>
<td>0.657</td>
<td>Reliabel &amp; Valid</td>
</tr>
<tr>
<td></td>
<td>DLE2</td>
<td>0.762</td>
<td>0.581</td>
<td>0.419</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DLE3</td>
<td>0.718</td>
<td>0.516</td>
<td>0.484</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DLE4</td>
<td>0.832</td>
<td>0.692</td>
<td>0.307</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AO</td>
<td>AO1</td>
<td>0.866</td>
<td>0.750</td>
<td>0.250</td>
<td>0.898</td>
<td>0.816</td>
<td>Reliabel &amp; Valid</td>
</tr>
<tr>
<td></td>
<td>AO2</td>
<td>0.939</td>
<td>0.882</td>
<td>0.118</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KBB</td>
<td>KBB1</td>
<td>0.905</td>
<td>0.819</td>
<td>0.182</td>
<td>0.949</td>
<td>0.822</td>
<td>Reliabel &amp; Valid</td>
</tr>
<tr>
<td></td>
<td>KBB2</td>
<td>0.898</td>
<td>0.806</td>
<td>0.194</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KBB3</td>
<td>0.939</td>
<td>0.882</td>
<td>0.118</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KBB4</td>
<td>0.884</td>
<td>0.781</td>
<td>0.218</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KB</td>
<td>KB1</td>
<td>0.875</td>
<td>0.766</td>
<td>0.235</td>
<td>0.924</td>
<td>0.752</td>
<td>Reliabel &amp; Valid</td>
</tr>
<tr>
<td></td>
<td>KB2</td>
<td>0.924</td>
<td>0.854</td>
<td>0.146</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KB3</td>
<td>0.874</td>
<td>0.764</td>
<td>0.237</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KB4</td>
<td>0.790</td>
<td>0.624</td>
<td>0.375</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
At the table above seen that all of Average Variance Extracted (AVE) are greater than 0.5. It means all of scales used in this study were valid statistically. At the table above seen also that all of Construct Reliability (CR) are greater than 0.7. It means all of scales used were reliable.

Furthermore, the proportion of variance of the construct has been tested by looking at the loading factors with the result seem at the figure below.

![Figure 2. The Proportion of Variance of the Construct.](image)

At the figure above seen that the Loading Factor or Standardized Loading Estimate of the constructs are greater than 0.5. It means the constructs have high variance proportion. Thus, the constructs have been pass in the validity Convergent Test.

Furthermore, the result of Structural Equation Modeling (SEM) analysis can see below:

**Table 2. Result of Structural Equation Modeling (SEM) Analysis**

<table>
<thead>
<tr>
<th>Model</th>
<th>Line</th>
<th>Coefficient Lane (Standardized)</th>
<th>T-statistic</th>
<th>R-square</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>EC → AO</td>
<td>0.584</td>
<td>7.599</td>
<td>0.422</td>
<td>Hypothesized Accepted</td>
</tr>
<tr>
<td></td>
<td>EED → AO</td>
<td>0.173</td>
<td>2.512</td>
<td></td>
<td>Hypothesized Accepted</td>
</tr>
<tr>
<td>Second</td>
<td>EC → SCA</td>
<td>0.150</td>
<td>2.099</td>
<td>0.638</td>
<td>Hypothesized Accepted</td>
</tr>
<tr>
<td></td>
<td>EED → SCA</td>
<td>0.117</td>
<td>2.041</td>
<td></td>
<td>Hypothesized Accepted</td>
</tr>
<tr>
<td></td>
<td>AO → SCA</td>
<td>0.650</td>
<td>8.026</td>
<td></td>
<td>Hypothesized Accepted</td>
</tr>
<tr>
<td>Model</td>
<td>Line</td>
<td>Coefficient Lane (Standardized)</td>
<td>T-statistic</td>
<td>R-square</td>
<td>Conclusion</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>----------------------------------</td>
<td>-------------</td>
<td>----------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Third</td>
<td>EC → BP</td>
<td>0.285</td>
<td>4.062</td>
<td>0.601</td>
<td>Hypothesized Accepted</td>
</tr>
<tr>
<td></td>
<td>EED → BP</td>
<td>0.125</td>
<td>2.082</td>
<td></td>
<td>Hypothesized Accepted</td>
</tr>
<tr>
<td></td>
<td>SCA → BP</td>
<td>0.515</td>
<td>6.799</td>
<td></td>
<td>Hypothesized Accepted</td>
</tr>
</tbody>
</table>

At the table above seen that all T-Statistic or Critical Ratio are greater than T-Table for alpha 0.05 (1.64). It means Null Hypothesis is rejected and Alternative Hypothesis is accepted. Thus, all hypothetical relationships were found to be significant statistically.

5. Conclusion

Based on analysis and discussion that had been done, the research result can be drawn of some conclusions. The result of hypothesis shows that:

- Entrepreneurial competencies and External environmental dynamism gives impact partially and simultaneously to Organizational Ambidexterity
- Entrepreneurial Competencies gives effecting to Sustainable Competitive Advantage.
- External Environmental Dynamism gives influences to Sustainable Competitive Advantage.
- Organizational Ambidexterity gives effecting to Sustainable Competitive Advantage.
- Sustainable Competitive Advantage gives influence to Business Performance.
- Entrepreneurial Competencies give impact to Business Performance.
- External Environmental Dynamism gives influence to Business Performance.

6. Implications of Results

From the research that has been done found that there are some strategic variables that needed to improving Business Performance. For improving Business Performance, companies can develop the Entrepreneurial Competencies, External Environmental Dynamism and providing Organizational Ambidexterity. In this, organizational ambidexterity can be created by developing the Entrepreneurial Competencies and creating the External Environmental Dynamism. Organizational Ambidexterity generating the Sustainable Competitive Advantage for providing Business Performance. Certainly, Sustainable Competitive Advantage as a mediating variable in developing Business Performance has important contribution. So, when the companies want to have a good Business Performance, they should have a good Sustainable Competitive Advantage by providing Organizational Ambidexterity. Else, the companies can develop their Sustainable Competitive Advantage by exploiting the External Environmental Dynamism and developing the Entrepreneurial Competencies. Furthermore, Entrepreneurial Competencies can develop the Business Performance. In this, the companies can develop their Entrepreneurial Competencies by providing the effective entrepreneurship training. Meanwhile, the companies should create the collaboration with their external environment for obtaining the efficiency in getting supply of good raw material with the cheaper price and gathering the good quality of human resources that needed in companies production process.
7. Further Research

This research found that Business Performance is impacted by Entrepreneurial Competencies, External Environmental Dynamism and Organizational Ambidexterity. So, the further research is expected to find another variables that can generate a good Business Performance. Another variables that enabling to be studied are Government Policy, Employee Quality, Employee Welfare, etc. The further research is suggested also to study the another mediating variables in generating Business Performance due to Organizational Ambidexterity not only generate Sustainable Competitive Advantage but also generate the rivalry in business that generating a good business competition atmosphere that expected to push emerging a good Business Performance.

8. Reference


THE IMPACT OF PERSONALITY, DISCIPLINE, STRESS TOWARD PERFORMANCE OF COLLECTOR CARD CENTER AT PT. BANK MEGA Tbk. JAKARTA

Gairah Sinulingga, Ina Primiana, Ria Ratna Ariawati and Eri Febrian

Doctorate Program in Management
Faculty of Economics and Business
University of Padjadjaran

Abstract

Collector’s performance, study of behavioral, work discipline and work stress to performance. This study aimed at gaining empirical data about the influence of personality, discipline and stress working stress toward collector’s performance. This study employed survey method on February 2009 – March 2009, sampling method was used random sampling method. This study involved 50 respondents. Hypothesis test drew the conclusions as followed: First, there is positive effect of personality toward collector’s performance, stated by coefficient of determination $r_{1y}^2 = 0.339$ variation of performance can be explained by other variables. Second, there is positive effect of work discipline toward collectors’ performance; is stated with coefficient determinacy $r_{2y}^2 = 0.390$ variation performance can be stated by work discipline 39%, the rest are stated by other variables. Third, there is positive effect of work stress toward collectors’ performance, is stated by coefficient determinacy $r_{3y}^2 = 0.206$ variation performance can be stated by work stress 20.6%, the rest are stated by other variables. Forth, there is positive effect of personality, work discipline, and work stress toward collectors’ performance, is stated by coefficient determinacy $r_{123y}^2 = 0.524$ variation performance can be explained by personality, work discipline, and work stress 52.4%, the rest are explained by other variables.

Key words: personality, discipline, work stress and performance

I. BACKGROUND

There are various banking products which are popular and have important role in facilitating people’s lives in conducting financial transaction. For instance are ATM, E-channel, E-commerce, SMS banking, Bancassurance and Credit Card. These products complete traditional banking products such as saving, giro, house ownership credit and deposit facilities.

Banking product as credit card is usually maintained by separate business unit which is called Card Center. In financial institution’s organizational structure, card center banking is in a separate Division or as separate business unit. There are also financial institution nonbanking which issue credit card.

Difficulties such payment would potentially be difficult to heap an unpaid debt and potentially problematic. For Credit Card Center if the bad it will affect the formation Allowance costs for Earning Assets that potentially decreased corporate profits. Therefore formed a separate working unit that monitors the credit quality of the card holder. This unit is often called Collection or receivable clerk (Collector) banking. They served to remind fall cardholder payment due, to reschedule the repayment schedule, keeping the collectibility of loans.

www.ijsrp.org
In recent personal financial activities, almost everyday customers conduct transaction using credit card as a medium of exchange. Credit card is mostly called "plastic card" is a debt card without collateral with basic concept "purchase now pay latter". Variety of benefits of transactional processes are easy to conduct by credit card without bringing some cash money, transaction with special discount and can be paid in installment, save and can be brought to draw cash money, with no worry of receiving counterfeit money, can conduct transaction in the internet, it is very useful in emergency situation when cash money is unavailable.

Besides variety of benefits which are attached in that product, it also has negative its negative effects in using uncontrollable credit card. Credit card is a debt which must be paid in accordance with payment deadline which is sent by Card center every month. If it is overdue the payment deadline so the users will be charged and interest. Transaction interest retail of credit card with a range of 2,5-3,5 % per month or per year 30-42 and 2,75-6 % per month or 33-72 per year for drawing cash money transaction in ATM (Helvi Indrawan, 2008 : 45).

Starting point from above explanation, so main duty, function and collectors’ authority is connected with their job is heavy. They have to concern on collectibility level of credit card, reducing amount of cost of PPAP and be directly monitored by Bank of Indonesia. Main duty can only be achieved continuously and constantly increase the number of credit card users to conduct payment. Hence, it is important to know that the relation and impact of work and other organizational factors toward performance of collectors credit card PT. Bank Mega Tbk. Those factors such as environment, personality, work discipline, work stress, motivation and work compensation, work tools, work condition, work load, demand and life challenge and work conflict which have to be maintained well.

1.1 Statement of Problems
1. Is there any impact on Personality toward Collectors’ performance of Card Center PT. Bank Mega Tbk?
2. Is there any impact on work Discipline toward Collectors’ performance of Card Center PT. Bank Mega Tbk?
3. Is there any impact on work Stress toward Collectors’ performance of Card Center PT. Bank Mega Tbk?
4. Is personality, work discipline and work stress simultaneously affected collectors’ performance of Card Center PT. Bank Mega Tbk?

1.2 Aims of the Study
1. The impact of personality toward collectors’ performance of Card Center PT. Bank Mega Tbk?
2. The impact of work discipline toward collectors’ performance of Card Center PT. Bank Mega Tbk?
3. The impact of work stress toward collectors’ performance of Card Center PT. Bank Mega Tbk?
4. The impact of jointly personality, work discipline, work stress toward collectors’ performance of Card Center PT. Bank Mega Tbk?

II. THEORETICAL FRAMEWORK AND HYPOTHESIS

2.1 Theoretical Framework

a. Employees’ performance

Employees’ performance is things that are done and undone by employees. Employees’ performance is components which impact on how far that they can make contribution toward the company, contribution which is in accordance with the responsible of each job. One of means which can be used to monitor the progress of the company is by monitoring performance assessment result.
Employees’ performance can be measured qualitatively and quantitatively through performance evaluation process. Evaluation of performance refers to formal and structured system which is used to measure, assess and affect the qualities which are connected with job, personality includes level of presence.

Performance assistance includes dimension of employees’ performance. Business competition which is more strictly demands the employees of a company to have high performance. At the same time, the employees need feedback from their working result as guidance for their behavior in the future.

b. The benefits of performance assessment

According to Veithzal Rivai (2008 : 315-316), employees’ performance assessment is viewed from company development’s perspective, especially human resources management, which have many benefits, such as:

a. Compensation adjustment

Performance assessment assist decision making in adjusting compensation, determine who need to get salary acceleration, incentive or other compensations. Many companies fulfill bonus, their salary acceleration based on performance assessment.

b. Performance improvement

Giving feedback for work implementation which benefits for employees, manager, and specialist personal is in form of activity to improve or to refine employees’ performance.

c. Training and developing

c. Performance assessment Criterion

According to A. Dale Timpe (1993 : 319) there are some factors which become criterions in evaluating performance:

1. Productivity improvement
2. Reducing error
3. Absteineesm and delay
4. Solving training cases
5. Reducing castoffs
6. Reducing number of customers complaints
7. Availability to accept displease duties

d. Personality

Personality type is characteristic, nature and character possessed by an individual that distinguish one person to another. An individual's personality type will determine the pattern of reaction to situations and events that directly and indirectly can take effect in an individual.

Friedman and Rosenman (2003: 6), to develop classification introverted personality types and personality type’s extrovert, which has the following characteristics:

a) An introverted personality type is characterized, among others, aware of the time, the spirit of competition, very ambitious, very aggressive, hardworking, set high targets for himself and others, have a high emotional.

b) Type of extroverted personality traits that would tend to show a very calm, relaxed, do not have excessive ambition, less prone to work stress and heart disease
Work discipline

Work discipline is a tool which is used by managers to communicate with employees in order they are willing to change a behaviour and as mean to improve one’s awareness and willingness to obey company’s rules and prevailing social norms.

Prayudi Atmosudirjo (1982 : 84), work discipline is defined as obedience and rational self-controlling, fully aware, not emotional and without string attached. In line with above opinion, Bejo Siswanto (1989:278), defines work discipline as an attitude of respecting, appreciating, obedience toward prevailing rules, both written and unwritten as well as capable to operate and not evade to accept sanctions if he disobey the duty and authority which are given him.

Cascio (1995:505) concerns on management to do the controlling. The emphasizing of work discipline on this definition in more to set of tool which is in form of rules or policies are controlling tools toward employees’ behaviour in order that employees’ behaviour aor their performance is in accordance with company’s rules and policies.

Harris (1995:289), work discipline is defined as exercising process of employees, so he can build self-controlling and is more effective in his performance. The direction of work discipline which is stated in the definition is self-controlling to improve working achievement so organization’s objective is achieved. Simillar opinion is stated by Werther and Davis (1995:515) that work discipline is “a mean of management to undertake in orther that the employees obey the standard/ rules in the organization”. This opinion considers that work discipline as a training to change and to correct knowledge, attitude and behaviour so that the employees will try to cooperate with and improve their performance for the company. Thus, among the knowledge, attitude and behaviour must be consistance.

Work Stress

Mangkunegara (2001:157), defines that work stress is pressure feeling which is experienced by employees in facing job. The symptomps appear in work stress, such as, unstrabble emotion, unstable feeling, anxiety, secluded, insomnia, excessive smoking, tense, anxious nervous tension, high blood pressure, and having indigestion.

Darley, Glucksberg & Kinchla (1991: 487) in Arafah (2005:423), explain that work stress is not always negative problem for anyone. If someone does not feel disturbed toward work stress is not a problem, but if is otherwise, it can disadvantage him.

Ivancevich and Mateson (2002: 400), explain that jobstress is interaction of the individual within environment”. Work stress is interaction between personal woth his environment. While in wide sense, that “Job stress is an adaptive response, mediated by invidual differences and/or psychological process, that is as a consequence of any external (environment) action, situation, or even that places excessive psychological and/or physical demands upon a person”

Sources of Work Stress

According to Mangkunegara (2001: 157) the cause of work stress, are: work load which is too heavy, low quality of controlling, unhealthy working climate, inadequate work authority which is related to responsibility, work conflict, different value between one employee to frustated leader in working.

Munandar (2004: 374) explains that work stress is result of incompatibility between one (interms of personality, talent, and skill) and environment, which cause inability to face variety of challange toward themselves effectivelly.

According to Veithzal Rivai (2008: 517), employees’ work stress can be caused by problems which happen outside organization. Causes of ”off the job” such as:

a) Financial awareness
b) Problems in relation to children
c) Physical problems
d) Marital problem (i.e.: divorce)
e) Changes happen in dwelling place
f) Other personal problems, such as relative’s death

h. Institution background

On April 15th, 1969 at Jl. Kembang Jepun 180-184 Surabaya a group of businessmen established Karman Bank which it was forerunner of Bank Mega. The bank operational was run by traditional and familial principles. Its segment market was retail sector, especially pulses and gold trading. New commitees of Karman Bank relocated its central office to Jakarta on March 18th, 1992 and change the name of the company into PT. Bank Mega. On March 28th, 1996 Para Group took over the whole share of PT. Bank Mega. Then, on June 18th, 1997, new era of new Bank Mega was launched, dtermination the logo and new slogan, as well as set the vision and mission of Bank Mega. In order to stengthen the structure, and capital, the company held IPO and recorded its share in Jakarta Stock Exchange and Surabaya Stock Exchange. Thus, half of PT. Bank Mega’ share is owned by public so it changes its name become PT. Bank Mega, Tbk.

In 2002 PT. Bank Mega, Tbk, added new division which is special handling credit card business. Based on directors’ directive number 006/DIRBM-HCMD/08 so GM card and unsecure loan have their own structure which consists of three head of divisions those are business card division, Card Operation and Risk dan Unsecured Loan Division. The writer centralizes the study on collection which attaches in Divisi Card Operation and Risk (CORD).

Head of division supervises two deputies (vice) each of Deputy Operation and Finance serta Deputy Credit and Risk. Deputy Operation and Risk supervises:

i. Empirical studies

Previous study was conducted by Dini (2008), entitled: "Pengaruh Kepribadian, Pengelolaan Konflik, Disiplin kerja terhadap Stres kerja" by using 50 respondents as sample with simple random method, while data analysis technique used in this study is statistical regression. Suwarno (2006), conducted a study entitled: "Hubungan antara Ketahanan Fisik Mental Spiritual dan Kemampuan mengelola stres serta Tingkat Kepercayaan Diri dengan Motivasi Kerja", by using 63 respondents as sample which consist of top, middle, and low level managers and it is taken with census. Statistical analysis technique which was used is double regression model with F and T test. The result reveals that there is positive relation among those three analyzed variables, which the range of 49,20% of determination coefficient.

2.2 Framework

a. The impact of personality toward collectors’ performance

Personality is human’s characteristic (employees) which can affect performance. Employees who are opened are willing to cooperate with their colleagues can improve their performance. Personality which its elements is duty awareness, always work with target, work step by step, have working spirit, work aggressive, calm, relaxed, ambitious, like their job can improve employees’ performance.

b. The impact of work discipline toward collectors’ performance
Work discipline which its elements are awareness of obeying the rules, work standard, consistence in working, consistence in using and maintaining work tools, and be able to self-correcting will influence performance. Employees will have good performance in doing their job if they obey the rule and work standards. The higher they obey the rule and work standard, the higher work achievement.

c. The impact of work stress toward collectors’ performance

Work stress is caused by overload and overworking, achievement target, job’s condition which is not conducive, conflict of role, caree development, work patent, conflict of ambiguity will impact on performance. In working, employees who determines how far those factors become the situation or work stress or, in contrast, those factors are considered as tools to motivate employees’ work thus they can enjoy their work without feeling burdened.

2.3 Research hypothesis

Based on elaboration of some theories which have been mentioned above, thus the hypothesis of this study are elaborated as followed:

H1 : there is significant effect of personality toward performance of Collector Card Center PT. Bank Mega, Tbk.
H2 : there is significant effect of work discipline toward performance of Collector Card Center PT. Bank Mega, Tbk.
H3 : there is significant effect of work stress toward performance of Collector Card Center PT. Bank Mega, Tbk.
H4 : there is significant effect of personality, work discipline, work stress simultaneously toward performance of Collector Card Center PT. Bank Mega, Tbk.

2.4 Definition of Operational Variable

Variables which are used in this variable consist of three independent variables and one dependent variable, which is briefly operated as followed:

1. Employees’ performance (dependent variable, Y) is size which give the idea of how far the work target can achieved, direct to the achievement of maximum work objective that is target achievement which is related to quality and quantity and time.
2. Personality (independent variable, X1) is task awareness, work step by step, have competitive sense, have working spirit, work aggressive, calm, relaxed, ambitious, and like working.
3. Work discipline (variable bebas, X2) is awareness of obedience to the rule, work standard, work consistency, consistence in using and maintaining tools and be able in self-correcting.
4. Working Stress (independent variable, X3) is ability of employees in maintatining emotion. That condition is caused by calm feeling and like working, sociable, and be able to solve personal problem, like discussing if there is a problem, comfort working environment, work load is inline with capability.

III. RESEARCH METHOD
Research method employed in this study are survey and questionnaire which is distributed to Collector Card Center PT. Bank Mega, Tbk. Jakarta. Survey method toward the relation pattern among variable is presented in picture as followed:

![Relation pattern among variables](image)

3.1 Population and Sampling

Population of this study are employees of Collector Card Center at PT. Bank Mega, Tbk. The sample of the research are 50 people, this study employs random sampling technique. All questionnaires in submitting and all can be used well in this study.

3.2 Data Analysis Technique

The data is analysed by using SPSS (Statistical Product Service Solution) release 18.0 (Stanislus S Uyanto, 2006) which is presented as followed:

1. **Realibility Analysis**, using coefficient of koefisien Alpha Cronbach. If value of Cronbach’s Alpha if Item Deleted is lower than value of total Alpha Cronbach, so that the measurement scale has good realibility.

2. **Normality test**, using Kolmogorov-Smirov test (K-S) or Liliefors and Shapiro Wilks, to find out the data distribution, whether it is normally distributed or not.

3. **Heteroskedastistas** test requirements are:
   a) There are none of points in scatterplot which form a certain even, waved, widened then narrowed pattern.
   b) There are none of clear pattern, and points in scatterplot scatter on above and below 0 in axis Y. Axis X is Y which is predicted, and Axis Y is residual, that is difference of predicted Y is diminished actual Y (Wahid Sulaiman, 2004:16).

4. **Autocorrelation test** to find out whether there is autocorrelation among analyzed variable in regression model, is conducted to Durbin-Watson test. Good Model is estimated parameter within quality of model (Best Linear Ubiased Estimator) or BLUE, which means ther is no correlation among variables. The condition is calculated DW must be lower than 2,35 means there is no autocorrelation (Wahid Sulaiman, 2004:16).
5. **Value of t-calculated Test** to examine the impact of regression coefficient of independent variable (X) to dependent variable (Y), toward the condition that t-calculated must be higher than t-table.

6. **Value of F-calculated test** to examine regression model toward the condition of F-calculated must be higher than F-table’s; F-calculated test is commonly called *Analysis of Variances*.

### 3.3 The Analysis of double regression

Common equation of simple regression is \( Y = a + bX \), in which \( a \) is intercept (constant) and \( b \) is slope (coefficient regression). Stanislaus S Uyanto (2006:209) explains R-square shows that description of dependent variable can be explained by independent variable. Regression statistically is considerably significant if F value and Sig. Value is lower than \( \alpha = 0.05 \). To test the significance of each regression coefficient is used T-test.

**Value of t and sig. Value, must be lower than \( \alpha = 0.05 \).**

**The Analysis of double regression**

Common forms of simple equation regression \( Y \) of \( X_1, X_2 \) and \( X_3 \) are:

\[
Y = a + b_1X_1 + b_2X_2 + b_3X_3 + e
\]

Stanislaus S Uyanto (2006: 218-223) explains that:

1. **R square value** shows from \( Y \) variant can be explained by variable change of \( X_1, X_2, X_3 \).

2. **Value of Durbin-Watson statistical test** about 0 and 4; if test value is lower than 1 or higher than 3, so residual or error from double regression model is not independent or there is autocorrelation (Stanislaus S Uyanto, 2006:218).

3. ANOVA table states that double regression statistically significant with statistical test F and P-value or Sig., is lower than \( \alpha = 0.05 \).

4. **Test F** examines hypothesis \( H_0: \beta_1 = \beta_2 = 0 \) to \( H_1: \beta_1 \) and \( \beta_2 \) is not totally 0. From P-value or Sig., is lower than \( \alpha = 0.05 \), so \( H_0: \beta_1 = \beta_2 = 0 \) is rejected significantly.

5. Double equation regression is gained by using least equation square, that is: \( Y = a + b_1X_1 + b_2X_2 + b_3X_3 \).

6. From Coefficients table it have to be viewed that value of VIF for \( X_1, X_2, X_3 \) must be about 0 – 4, is considered as there is no multicollinearity occurred.

7. From Normal Probability Plot is seen that data points form linear pattern so it is consistence with normal distribution.

8. Scatter plot between standardized residula ”ZRESID” and standardized predicted value ”ZPRED” do not form certain pattern, so that it can be considered as residual which have constant variant (homoscedasticity).

### IV. STUDY RESULT

#### a. Validity test

The result of validity test toward questions of each investigated variable, are, personality, work discipline, work stress, and performance, is conducted based on repondents’ response.

#### The Result of Validity Test of Research Instrument

<table>
<thead>
<tr>
<th>Statement number</th>
<th>Value r-calculated Research Variable</th>
<th>Testing with r</th>
<th>Test result</th>
</tr>
</thead>
</table>

[www.ijsrp.org](http://www.ijsrp.org)
The result of validity variable testing of investigated personality, work discipline, work stress which is gained from result of validity test in which value of r-calculated to all investigated questions variables are higher than value of r-critical =0,3 in which the lowest number of r-calculated 0,32 and the higher 0,75. Testing criterions are if value of r-calculated > r critical, so the questions are valid, if r-calculated < r so the questions stated are not valid. It means that personality variable, work discipline, work stress are valid construction for collectors’ performance variable and can be used in further statistical analysis.

b. Reliability Test

Besides the validity test, an research instrument needs other test such as reliability. Reliability test toward research questionnaire is meant to analyze whether research questionnaire is statistically used from each variable which is investigated is stated reliable. Reliability analysis uses koefisien Alpha Cronbach’s. If value of Cronbach’s Alpha if Item Deleted is lower than the total Alpha Cronbach’s value, so measurement scale has good reliability. Test toward the variable is based on output, the result is shown on table 4.2, as followed:

<table>
<thead>
<tr>
<th>No</th>
<th>Variabel</th>
<th>Nilai r Test</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total Alpha</td>
<td>Alpha If Item Deleted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Personality</td>
<td>0,7859</td>
<td>0,7263</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Work discipline</td>
<td>0,7859</td>
<td>0,7419</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Work stress</td>
<td>0,7859</td>
<td>0,7799</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>performance</td>
<td>0,7859</td>
<td>0,6794</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Tabulation Resul of SPSS

On Tabel 4.2. above, based on the result of realibility analysis from investigated quetionaire based on each Cronbach’s Alpha value. Four variables which are investigated or used questionnaire is realible, because Personality, work discipline, work stress and Performance have lower value of Cronbach’s Alpha If Item Deleted than the total value of Cronbach’s Alpha. It shows that the sample that is taken from population is normal distribution. Based on the realibility test, so the instrument (variables) can be used in further statistic analysis, or can be stated that those variable can be used as research instrument.
c. Analysis Requirement Test

Normality test:
Remark: $X_1$ = personality, $X_2$ = work discipline, $X_3$ = work stress and $Y$ = performance.
Asymp. Sig. value (2.-tailed) shows: $(X_1) = 0.585$ $(X_2) = 0.364$ $(X_3) = 0.354$, and $(Y) = 0.193$ is higher than $\alpha = 0.05$, it shows that sample taken from population is normal distribution.

Heteroskedasitisas Test
Decision making to heteroskedasitisas test based on condition:

i. If there is certain pattern, such as points which form a particular regular pattern (wave, widened then narrowed) so heteroskedasitisas has occurred.

ii. If there is not clear pattern, and points are scattered above and below 0 on axis $Y$, so Heteroskedasitisas has not accurred. From the test result, it is gained scatter plot as followed:

The result of test on Picture above, thus it is known that independent variable data (points) scattered randomly, and they do not form a certain clear pattern, and the data are scattered both above and below 0 on axis $Y$ so what happen is homoskedasitas.

Multicollinearity Test
Remark: $X_1$ = personality, $X_2$ = work discipline, $X_3$ = work stress and $Y$ = performance. Collinearity statistic: Tolerance about 0-1, with 0=high collinearity and 1=low collinearity. VIF = Variance Inflation Factor, about 1 – Infinity, dengan 1= low collinearity. Stanislaus S. Uyanto (2006:224) states that VIF = 2 - 4 is still considered as low collinearity. Based on above data VIF value shows: $(X_1)= 1,415$ $(X_2)= 1,313$ $(X_3)= 1,270$ all are about 0 – 4 and tolerance value show $(X_1)= 0,707$ $(X_2)= 0,762$ $(X_3)= 0,787$ all are near 1. It show that there is no multicollinearity

Autocorrelation Test
Remark: $X_1$ = personality, $X_2$ = work discipline, $X_3$ = work stress and $Y$ = performance. Collinearity statistic: To detect the presence or the absence of autocorrelation according to Wahid Sualiman(2004:89) is conducted by Durbin-Watson test (DW), through following condition as folowed:

a) $DW < 1,21$ or $DW > 2,79$, means there is autocorrelation.

b) $1,65 < DW < 2,35$, there is not autocorrelation.

Based on analysis result, DW value is $2,097 < DW 2,35$, means there is not autocorrelation.

Linearity Test
Remark: X₁ = personality, X₂ = work discipline, X₃ = work stress and Y = performance.
Regression model is in form of linear if Sig. deviation from linearity higher than α = 0,05.

**Hypothesis Test**
The purpose of hypothesis is to gain the conclusion whether the hypothesis of this study has been formulated and supported by collected empirical data. This hypothesis test is conducted by statistic approach, thus tested hypothesis is statistical hypothesis which is stated in form of null hypothesis (H₀).

**The impact of personality (X₁), toward collectors’ performance (Y)**
Regression equation: Ŷ = 14,976 + 0,567X₁, means every addition of a unit (one unit) of independent variable of work stress (X₁) will impact on collectors’ performance (Y) by 0,567 unit. Coefficient determination (R Square) 0,339 means by 33,9 % of performance can be affected by work stress. Based on ANOVA table gained calculated F value = 24,587, Sig 0,00 < α 0,05, means H₀ is rejected, thus there is an effect of work stress (X₁) toward collectors’ performance (Y).

**The impact of discipline (X₂), toward collectors’ performance (Y)**
Regression equation: Ŷ = 8,004 + 0,840X₂, means every addition of a unit (one unit) of independent variable of work stress (X₂) will impact on collectors’ performance (Y) by 0,840 unit. Coefficient determination (R Square) 0,390 means by 39% of performance can be affected by work stress. Based on ANOVA table gained calculated F value = 30,651, Sig 0,00 < α 0,05, means H₀ is rejected, thus there is an effect of work stress (X₂) toward collectors’ performance (Y).

**The impact of work stress (X₃), toward collectors’ performance (Y)**
Regression equation: Ŷ = 16,779 + 0,523X₃, means every addition of a unit (one unit) of independent variable of work stress (X₃) will impact on collectors’ performance (Y) by 0,523 unit. Coefficient determination (R Square) 0,206 means by 20% of performance can be affected by work stress. Based on ANOVA table gained calculated F value = 12,480, Sig 0,001 < α 0,05, means H₀ is rejected, thus there is an effect of work stress (X₃) toward collectors’ performance (Y).

**The impact of personality (X₁), work discipline (X₂), and work stress simultaneously toward collectors’ performance (Y)**
Regression equation: Ŷ = 0,858 + 0,307X₁ + 0,564X₂ + 0,200X₃, means all independent variables positively jointly impact on collectors’ performance (Y). Intercept value 0,858 means that if personality (X₁), work discipline (X₂) and work stress (X₃) on the value of 0, so performance (Y) = 0,858. That interpretation is meaningless because there is not collectors’ performance which is influenced because personality, work discipline, works stress is negative. Theoretically, it is not justified because this study does not involve (X₁), (X₂), (X₃), which have value of 0. Partial regression coefficient (X₁) = 0,307 can be interpreted on (X₂), (X₃), which constant to the improvement (X₁) one unit can improve Y by 0,307 unit. Partial regression coefficient (X₂) = 0,564 can be interpreted on (X₁) and (X₃), which constant to the improvement (X₂) one unit can improve Y by 0,564 unit. Partial regression coefficient (X₃) = 0,200 can be interpreted on (X₂) and (X₃), which constant to the improvement (X₁) one unit can improve Y by 0,200 unit. Coefficient determination (R Square) 0,524 means 52,4 % all independent variables jointly impact on dependent variable (Y). While, the rest is 47,6 % is affected by other factors. Based on ANOVA table gained calculated F value = 16,883, sig 0,000 < α 0,05, means H₀ is rejected, thus there is an effect of (X₁), (X₂), and (X₃) jointly toward collectors’ performance.

**Discussion**
The impact of personality toward collectors’ performance
Personality (independent variable, X₁) impacts on performance because employees who have duty awareness, they work with achieved targets, they work step by step, reasonable competition, they work with high spirit, they are aggressive in doing their work; they are calm and relaxed in doing their work, they are not too ambitious, they like working. Those factors improve their performance.

The impact of work disciplinetoward collectors’ performance
Work discipline (independent variable, X₂) impacts on collectors’ performance. Employees who obey the rules will impact on their own performance, and the employees who follow the standard performance well will also impact on their own performance. Likewise, employees who are consistence in working can improve their performance and they are who consistence in keeping and maintaining working tools will also improve the performance.

The impact of work stress toward collectors’ performance
Work stress (independent variable, X₃) impacts on collectors’ performance. Employees who can cope with personal problem will impact on their performance, and employees who can manage their emotion well while they are communicating with customer also can improve their performance. Likewise, employees who are please to discuss if there is a problem will also improve their performance and they who have reasonable expectation. The most important, employees enjoy working not burden but it is a noble task which can improve their performance.

The impact of personality, work discipline and work stress simultaneously toward collectors’ performance
The concept of performance stands for kinetic working energy. Performance (dependent variable) is output of functions or indicators of an occupations or a profession in certain period. Employees’ performance is a component which influences how far they can make contribution for the company. That contribution is influenced by personality, work discipline and stress. Employees who have good personality, maintaining work discipline and being able to maintain work stress will be able to improve their performance.

The result of this study shows that personality, work discipline and stress partially impact the improvement of performance. It can be implicated that to improve collectors’ performance it is required at least 3 factors which have to be improved, those are, personality, labor discipline, and stress. Those three factors have positive effects toward the improvement of performance.

V. CONCLUSIONS

Level of accomplishing of collecting funds from debtors will make contribution toward the level of achieving profit which can be recorded by the company. From the result of this study, to support that accomplishment, there are some efforts which can be done as followed:

1) Improving the performance of collectors i.e. through compensation adjustment and commission, training, making planning and good career development.
2) Improving level of maturity of personality of collectors continuously so that they focus only on billing effort and they are not disturbed by other activities. For instance, sending collector staff to participate in training about interpersonal and social skill, negotiation and so on.
3) Maintaining and improving collectors’ level of discipline. It can be done by making standard and clear working procedures, implementation of punish and reward systems for indiscipline employees, and disciplined and employees achievement in accomplishing the target set.
4) Reducing the level of stress on the collectors in working. It can be done by creating conducive working atmosphere, avoiding, as small as possible, conflict among employees or with the leader. Unit leader
should be able to identify factors which cause stress and control it appropriately so the collectors can work comfortably.

VI. IMPLICATION

Based on the results obtained in this study, the researchers gave the following suggestions:

1. The Company should increase the maturity of the employee's personality through the way of increasing the awareness of a member organization. They should be increased knowledge that they are part of the organization, the Collector shall be subject to the norms of the organization and uphold the high values of the organization.

2. Companies should regularly monitor the level of discipline Collector developments in work so that they work more efficient and effective in carrying out the tasks given.

3. Based on the findings that contribute to the improved performance of work stress has a small effect compared to the other independent variables. The trick is to frequently review the daily and monthly targets.

4. Companies should increase the maturity of personality, work discipline to manage the level of work stress the Collector in order to improve their performance in collecting funds from customers.

5. Companies must increase Collector active role in collecting such as asking them to contribute billing how most favorable to the debtor. This will increase the impact of their competence and loyalty to the company.

References

Brealey, Erica, Ten Minute Stress Relief, Batam: Karisma Publising Group, 2002.
Covey, Stephen R. The 7 Habits of Highly effective People, Terjemahan Budijanto, Jakarta: Binarupa Aksara, 1997.
Harris, Jr O. Jeff, Managing People at Work, New York: John Wiley & Sons, Inc, 1995.


http://ajielazmi.multiply.com/journal/item/3

http://id.wikipedia.org/wiki/Bank

http://one.indoskripsi.com/node/1141

http://zepbees.wordpress.com/2008/02/28/manajemen-proyek-sistem-kliring-nasional/
THE IMPACT OF CAPABILITY INNOVATION TO MARKETING PERFORMANCE THROUGH VALUE CREATION AT THE CENTER OF SMALL AND MEDIUM KNITTING INDUSTRY IN BANDUNG

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Abstract

The problems faced by the entrepreneurs incorporated at the center of small and medium enterprises (SMEs) of knitting industry in Bandung vary. The weak innovation capability causes a low value creation and implies in the reduction of marketing performance.

This research aims to investigate the relation between the marketing performance in small and medium enterprises (SMEs) knitting industry in Bandung (Indonesia) which is influenced by innovation capability and value creation.

The methodology used in this research is the Descriptive Analysis conducted with 281 respondents of entrepreneurs of SMEs at the knitting industry center in Bandung. The scores are calculated using LISREL 8.7 and scoring method to obtain grand mean of each variable. Structural Equation Model (SEM) is also used as the quantitative analysis to test all hypotheses in accordance to the research aims.

The result of this research shows that there is a significant impact, both direct and indirect, from innovation capability and value creation to the marketing performance of the SMEs at the center of knitting industry in Bandung.

Keywords: knitting industry center, innovation capability, value creation, marketing performance

BACKGROUND

Small and Medium Enterprises (SMEs) in Indonesia contributes significantly to economic growth, with employment absorption of 99.74% of the total national absorption and contributes to Gross Domestic Product (GDP) of IDR 1,013.5 trillion or 56.73% of Indonesian GDP. (Disperindag Sumedang.go.id, 2014). In Indonesia, SMEs is the subject of discussion and the government concern since they are spread throughout Indonesia and provide a potential job opportunities. They contributes to the economic development of Indonesia in various ways, such as creating employment opportunities, expanding the labor force for urbanization, and providing the need for flexibility as well as economic innovation in general.

Nevertheless, there are various problems faced by the SMEs. According to Mensah (2004) in Agyapong (2010), the SMEs entrepreneurs obtains only limited formal education, have a weak access and utilization of technology as well as a weak managerial skill, often faced an extreme capital volatility, and unability to obtain both technical skill and technology that hinders them from various opportunities.

The SMEs at the center of knitting industry in Bandung also faced various problems. One of the main problem is the lack of creativity of the entrepreneurs that cause to a weak innovation capability. Many of the entrepreneurs only follows the trend from a few creative entrepreneurs rather than strive to be creative in...
designing a unique and superior products. Even though, managing creativity and innovation capability are
the fundamental elements of an innovative organization (Saunilla & Ukko, 2012).

Dobni (2010), concludes that company with high innovative orientation involves in the strategy of value
creation, for instance by developing new products and/or services, creating in both radical or incremental
change, based on the needs and demand of their customers (Baregheh et al., 2012). Yang et al., (2009)
statement that innovation can be considered as the ability of an organization, because it is the act of spreading
resources with a new capacity to create value (Yang et al., 2009). Thus, the weak innovation capability at
the center of knitting industry in Bandung causes a low value creation, that become on of their main problem.

Therefore, Innovation is increasingly recognized as the main contributor to the success, performance and
viability of organization. Innovation is often driven by the pressure from external environment such as
competition, deregulation, the scarcity of resource and customer demand, and related to the adaptive
behavior that changes the organization in order to maintain or improving their performance (Damanpour,
2009 in Baregheh et al., 2012).

The weak innovation capability and the low value creation eventually causes a declining in marketing
performance. This due to the innovation capability is unable to create values in accordance to the needs and
demand of the customers. Although, to increase the marketing performance on an ongoing basis, the
company is required to be able to create superior value so as to produce a unique and provides more benefits
over competitors (Da Gama, 2011; Bonoma & Clark, 1988; Woodburn, 2006).

Thus, this research aims to investigate the impact of innovation capability and value creation to the
marketing performance of the SMEs at the center of knitting industry in the city of Bandung. The findings
in this research will provide an overview to the SMEs at the center of Knitting Industry at BinongJati and
Margasari in Bandung the importance of innovation capabilities to create a superior value and improve their
marketing performance.

LITERATURE STUDY AND RESEARCH MODEL FRAMEWORK

1. Innovation Capability

a. The concept of innovation and innovation capability

Innovation according to Bessan & Tidd (2011) comes from the Latin words *in* and *Novvare*, which
means 'making something new' or change something (*to change*). Baregheh *et al.*, (2012), defines
innovation as a multi stage process where organization transforms ideas into a new product or improving
service or process. While Subramanian & Mosleshi (2013) states that innovation as the implementation of
creative and useful ideas into reality.

A more operational definition of innovation as described by the experts is that innovation extensively
defined as a new products, products improvement (which already existed), new production techniques, new
organizational structure, new markets discovery as well as new discovery of input factors (Baregheh et al,

To be innovative, an organization should be able to develop their innovation capability. Managing creativity
and innovation capability is one of the fundamental element of an innovative organization. It is essential for
future success, since organization operates in an uncertain environment (Saunilla & Ukko, 2012:355).

The definition of innovation capability from various experts are summarized as follows:

<table>
<thead>
<tr>
<th>Writer</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lin <em>et al.</em> (2010)</td>
<td>Innovation capability is a new implementation or new creation in organisation based on technology applied in system, policy, program, product, processes or tools and services (Chang &amp; Le, 2008; Damanpour &amp; Evan, 1984)</td>
</tr>
<tr>
<td>Writer</td>
<td>Definition</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Forsman &amp; Rantanen (2011)</td>
<td>Product innovation capability as the ability to acquire and assimilate external knowledge, to turns it into unique competence and new ideas, and make it as a newness pioneer here in after effectively commercialize it</td>
</tr>
<tr>
<td>Baregheh et al (2013)</td>
<td>Innovation as a multistage process where organisation transform ideas to a new product/service/process or develop existing product/service/process to develop, compete and differentiate themselves succesfully in market</td>
</tr>
<tr>
<td>Toma et al. (2014)</td>
<td>Innovation as a multidimensional concept where the company focus to product, process and service as an implementation from gradual modification.</td>
</tr>
<tr>
<td>Saunila et al. (2014)</td>
<td>Innovation capability as a set of interlinked routines in a company to perform a certain tasks</td>
</tr>
</tbody>
</table>


From the definition of innovation capabilities above, it can be concluded in this research that "innovation capability is the managerial and technical ability in applying new ideas into work process to be more effective, efficient and productive that able to fulfil the customer requirements, competitive and able to increase sales".

b. The dimensions of innovation capability

Innovation is not applied only in large companies, but also to the SMEs sector (Baregheh et al., 2012). Various references and researches that are related to innovation capability have revealed multiple dimensions and indicators which are used by previous researchers that can be summarized as follows:

- **Forsman & Rantanen, (2011):** Capabilities for knowledge exploitation, Entrepreneurial capabilities, Risk management capabilities, Networking capabilities, Development capabilities, Change management capabilities, Market and customer knowledge
- **Toma et al., (2014):** Product innovation, Innovation process, Innovation management, Innovation service, Innovation administration
- **Saunila et al., (2014) :** Participatory leadership culture, Ideation and organising structures work, climate and well-being, Know-how development, Regeneration, External knowledge, Individual activity

Based on the identification of innovation capability concept as well as the observations of the phenomenon, the lack of innovation at the knitting center in Bandung, the dimensions used in this study are adopted from the research of Forsman & Rantanen, (2011) and Saunila et al (2014) i.e leadership for innovation, individual knowledge and creativity, innovational climate and culture, networking and collaboration, innovation process, and innovation outcome, since it is considered to be in accordance with both internal and external conditions of SMEs where the research is conducted.

2. Value Creation

a. The concept of value and value creation

In marketing, value is defined in its relation with the ownership of the goods which called as a trade-off (exchange) between the benefits gained from ownership and the sacrifices made to possession (Anderson & Narus, 1999; Monroe, 1990; Zeithaml, 1988). The conception of value assumes the value contains in products and services, creates value related to uncover needs, design solutions, manufacture solutions and transfer the solutions to customers in exchange for something else (La Rocca & Snehota, 2014).
Furthermore, Lindman (2013; 40) defines value creation as the ability of a company to create and deliver value by an effective management from supply chain, shared network, or customer relations which forms the main source of value creation.

Some researchers analyze the value creation from what it is called as functionalist perspective. The basic premise underlying this approach is that the company can execute a series of functions that create value for its partners and consumers (Sanchez et al., 2008). Kotler & Keller (2009: 136) confirms that the value perceived by customer (CPV - Customer Perceived Value) is the difference between the assessment of prospective customers to all the benefits and costs of an offer for the alternatives. Total customer benefits is a monetary value of economic benefits collection, functional and psychological expected by customer from a market supply which is caused by products, services, personnel and image involved. While Total Customer Cost is a collection of perceived costs that are expected by customers to be issued in evaluating, obtaining, using and discard a market supply including monetary cost, time, energy, and psychological.

b. The dimensions of value creation

Various references of sources and studies related to value creation have revealed some dimensions and indicators used by previous researchers such as:

- Kotler & Keller (2013): Benefit Customer, Bussines Area, Bussines Patner/Network
- La Rocca & Snehota (2014): networked sales organisation, architecture of collaboration, distributed knowledge system
- Chung (2015): Quality capability, Service Capability, Cost control capability, Speed capability, Innovation capability

The dimensions of value creation used in this study are taken from the opinion of Kotler & Keller (2013) i.e Benefit Customer, Bussines Area, Bussines Patner/Network since they are perceived to be suitable with the conditions where the study is taken place at the center of knitting industry in Bandung.

3. Marketing Performance

a. Performance and Marketing performance

Neely et al., (2005) in Saunila & Ukko (2012) defines the measurement of performance as "the process of measuring the efficiency and effectiveness of an action". Performance measurement can also be defined as to measure the input, output or activity level of an event or process (Radnor & Barnes, 2007).

Furthermore, in different terms, Saunila & Ukko (2012) indicates the following requirements for performance framework measurement (Laitinen 2003):
- It should include all important perspectives
- The measurements must contain a sound logical collection
- The framework should be useful for decision-making
- The framework should be able to improve the performance
- The short-term measurements must able to predict the long-term measurements

From organizational point of view, Da Gama (2011) describes performance as something scalable, dynamic, relative and multidimensional. Keats et al., (2008) in Da Gama (2011) defines marketing performance as organizations capability to transform themselves to face the challenges from the environment with long-term perspective.

b. The dimensions of marketing performance

Based on the opinion of some experts on the indicators that used to measure the marketing performance, this study sought to combine two theoretical concepts based on the researchs of Da Gama
(2011), Mone et al., (2013) and Kosan (2014) in order to measure the marketing performance of the center of knitting industry in Bandung.

The following list are the dimensions of marketing performance from several researches:

- **Green Jr, Inman, Brown, & Wilis (2005):** Market share growth, Percentage new product sales, ROI
- **Sulliven Don (2007):** Sales growth, Profitability, New product Success
- **Antonio Pimenta da Gama (2011): Marketing Performance** (Quality, Customer Satisfaction, Customer Loyalty, Brand equity, Market Share), **Financial Performance** (Sales revenue, Profit margin, Cash Flow)
- **Mone et al., (2013):** Financial output (profits, sales, cash flow), Non-financial output (market share, customer satisfaction)
- **Levent Kosan (2014): Non Financial Out Put** (Market share, customer satisfaction, customer loyalty/retention, brand equity, innovation), **Financial Out Put** (Sales analyses, Market share analyses, The ratio of marketing and sales expenditure to sales)

The measurements of marketing performance used in this research are sales volume, profit and market share (Levent Kosan, 2014; Mone et al., 2013; da Gama, 2011) since they are perceived to be suitable with the conditions where the study is taken place.

4. **Research framework and hypotheses**

In order to fulfill the customer needs, product offerings must be adapted in accordance with the customers’ needs and demands. Each business has a different approach to implement innovative ideas. Things that determine an organization will be successful in implementing innovative plan which will depend how organizations approach new ideas (Urhuogo & Williams, 2011: 80).

Meanwhile, marketing performance is the measurement of the company’s success represented by output achieved based on their ability to reach sales target, profit, sales and consumers’ growth. Sales growth through innovation capability of the company that sees the consumers as their source of income and be maintained by the creation of superior value for the realization of customer satisfaction and loyalty.

From the framework description above it can be concluded that market performance is affected by the innovation capabilities through the creation of superior value. This framework is based on various theories about the relationship between variables of several previous studies and the expert opinion which is further described as follows:

1) **The linkage between innovation capability and value creation**

The relation between innovation capability to value creation can be seen from a number of empirical studies that have been conducted by previous researchers. Herskovits et al (2013) argues that there is a strong relation between innovation openness to value creation. It is also supported from the results of Shamah (2012) which aims to test the service supply chain management that is environment-oriented at the hotel to improve performance productivity and the innovation level for value creation. The research results have been gotten by promoting innovation in the service value chain which can create a positive and significant value.

Further the research of Grimald et al., (2012), who examines the capacity of innovation community to improve the value creation process which also found a strong relation from innovation capacity to value creation. This finding is supported by Malik et al., (2011) that aims to be a consideration in the organizational culture that organizational innovation and its impact on the role of cost management technique in value creation. The research sample in his research are 300 accounting management professionals from various industries in Pakistan. From his research it is found that innovation can effectively save the cost for value creation.

Thus, the hypothesis in this research can be formulated:

**Hypothesis 1:** There is a positive and significant correlation between innovation capability and value
2) The linkage between innovation capability and marketing performance

The problem faced by Small Medium Enterprises (SMEs) in general lies in their ability to develop an innovative operational system in the company. According to Forsman & Annala (2011) most of SMEs are biased towards the development of incremental innovations that are produced in different types of innovation: products, services, processes, production methods and single function. As well as stated by Koc & Ceylan (2007) in Fernandes (2013) that an effective implementation of innovation has gained the level of recognition for sustainable competitive advantage to improve organizational performance.

The importance of innovation relation to performance is expressed by Saunila (2012), which is quoted from Alison et al., (2007), as follow:

“An organization’s competitiveness will be even more dependent on its ability to produce innovations in the future. Thus, it can be assumed that an organization’s performance is more and more dependent on its innovation capability (Allison et al., 2007)”.

It also similar with the research conducted by Damanpour (2009) which cited by Baregheh et al., (2012) said:

“Innovation is increasingly recognised as having an important contribution to make to organisational success, performance and survival. Damanpour (2009) suggests that innovation is often driven by pressure from the external environment, including factors such as competition, deregulation, isomorphism, resource scarcity, and customer demand, and that it is associated with adaptive behaviour that changes the organisation in order to maintain or improve its performance”.

The research conducted by Saunila et al., (2013) at small and medium enterprises (SMEs) in Europe strengthens the opinion above. From the result’s findings, there is a positive and significant impact between innovation capabilities on performance is obtained.

Thus, it can be concluded that the innovation capability has linkage to the marketing performance and the hypothesis can be formulated as follows:

**Hypothesis 2**: There is a positive and significant correlation between innovation capability and marketing performance

3) The linkage between value creation and marketing performance

Company marketing is always directed to generate performance, either in the form of marketing performance (such as sales volume, market share and the growth rate of sales) or financial performance (Mone et al., 2013). Almost every marketing studies links the value acceptance offered to customers as the basis of customer satisfaction in forming loyalty. A superior value offering is transformed into product in order to creates value for consumers. A customer satisfaction will improve the marketing performance of a company so that it can make a success of the undertaken business.

The research on value creation has conducted by Tourmuis (2013), saw the customer value can establish marketing performance. The research resulted that value acceptance and customer satisfaction has a strong relation between cognitive and emotional customers to make purchase and improve the performance.

Further the research conducted by Da Gama (2011), that aims to form a model based on company marketing asset that includes quality, satisfaction and customer loyalty, as well as brand strength and market share to form marketing performance. The position of the proposed model itself function as a tool that allows condition measurement in determining good marketing practices and its contribution to value creation.

Therefore, the hypothesis can be formulated as follows:

**Hypothesis 3**: There is a positive and significant correlation between value creation and marketing performance
4) The linkage between innovation capability to marketing performance through value creation

Value creation can be seen as intermediary between innovation capability and marketing performance, where a superior value creation function as the outcome from a high innovation capability in order to improve marketing performance. Herkovits et al., (2013) found that value creation is based on the openness of innovation.

This could happen since the company possess the ability to implement creative ideas into reality (Subramaniam & Mosleshi, 2013) then to change them into a new products (Baregheh et al., 2012) that creates and delivers value to the customers (Lindman, 2013) and provides benefit to cutomers (Kottler & Keller, 2013), increasing the company’s profit (Moneet et al., 2013) and market share (da Gama, 2011; Moneet et al., 2013; Kosan, 2014) thus increasing the marketing performance as the result of the formation of a strong relationship between the cognitive and emotional aspects of the cutomers in making purchase (Tournuis, 2013).

Based on description above, the hypothesis can be concluded:

**Hypothesis 4:** There is an influence of innovation capabilities on marketing performance through value creation

Based on the framework and findings from previous researches, a research model paradigm and hypothesis can be built that link all the variables suitable in this model study and can be described as follows:

![Research Model](image-url)

**Figure 1 Research model**

**RESEARCH METHODOLOGY**

1. **Population and Sampel**
   This research is uses sampling method conducted to 281 respondents of entrepreneurs incorporated at the center of knitting industry in Bandung and be processed using Structural Equation Modeling (SEM).

2. **Measurement and variable testing**
   The average score of each indicators is measured using scoring method and LISREL 8.7 software to obtain the grand mean in order to find out the impact of each exogenous latent variable to the endogenous latent variable. Moreover, the Structural Model Equation (SEM) is also used as the relevant quantitative analysis to test each hypothesis in accordance with the aims of the research. In this research model, two types of models are formed, the measurements model to describe the variance proportion of each manifest variables that can be described in latent variable to find out which dimension is more dominant in reflecting the latent variable and the structural model in order to review the impact of each exogenous latent variable to the endogenous latent variable.
DISCUSSION AND RESULT

a. Descriptive Analysis

Based on the data obtained from the respondents the condition of each variable can be known. In order to be interpreted, categorization of the mean score of the respondents' response is needed based on the spread between the maximum and minimum score divided with the number of the category.

1). Innovation Capability

In order to obtain a comprehensive description of the innovation capability variable, the average score of the response from respondents on the 26 questions is calculated to obtain the grand mean value of 3.34. Thus, it can be concluded that innovation capability of the SMEs of Binong Jati and Margasari is sufficient.

2). Value Creation

Three dimensions of value creation show a good/high result with the value of grand mean of the average score of the respondents is 3.37 which means that most of the SMEs at Binong Jati and Margasari are quite capable to create value.

3). Marketing Performance

The value of grand mean is 3.28 classified as sufficient. It means that most of SMEs at Sentra Rajut Binong Jati and Margasari already have a sufficient marketing performance.

b. Hypotheses testing

1). The partial influence of innovation capability to value creation

Hypothesis:

\[ H_0 : \gamma_{1.2} \leq 0 \quad \text{Innovation capability partially has no positive impact to value creation of the SMEs of knitting industry in Bandung.} \]

\[ H_a : \gamma_{1.2} > 0 \quad \text{Innovation capability partially has positive impact to value creation of the SMEs of knitting industry in Bandung.} \]

2). The direct influence of innovation capability to marketing performance

Hypothesis:

\[ H_0 : \gamma_{22} \leq 0 \quad \text{Innovation capability has no positive impact to marketing performance of the SMEs of knitting industry in Bandung.} \]

\[ H_a : \gamma_{22} \neq 0 \quad \text{Innovation capability has positive impact to marketing performance of the SMEs of knitting industry in Bandung.} \]

3). The partial influence of value creation to marketing performance

Hypothesis:

\[ H_0 : \gamma_{21} \leq 0 \quad \text{Value creation partially has no positive impact to marketing performance of the SMEs of knitting industry in Bandung.} \]

\[ H_a : \gamma_{21} \neq 0 \quad \text{Value creation partially has positive impact to marketing performance of the SMEs of knitting industry in Bandung.} \]
4). The influence of innovation capability to marketing performance through value creation

Hypothesis:

\[ H_0 : \gamma_{1.2} \times \beta_{2.1} = 0 \]

Indirectly through value creation, innovation capability has no positive impact to marketing performance through value creation of the SMEs of knitting industry in Bandung.

\[ H_a : \gamma_{1.2} \times \beta_{2.1} \neq 0 \]

Indirectly through value creation, innovation capability has positive impact to marketing performance through value creation of the SMEs of knitting industry in Bandung.

![Figure 1: Structural Model](image)

**Tabel 2**

<table>
<thead>
<tr>
<th>Model</th>
<th>t statistic</th>
<th>Significant value</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN = 0.73 * KI</td>
<td>9.33</td>
<td>Significant</td>
<td>53%</td>
</tr>
<tr>
<td>KP = 0.23 * KI</td>
<td>9.76</td>
<td>Significant</td>
<td>34%</td>
</tr>
<tr>
<td>KP = 0.70 * PN</td>
<td>8.73</td>
<td>Significant</td>
<td>57%</td>
</tr>
</tbody>
</table>

**Tabel 3**

<table>
<thead>
<tr>
<th>Model</th>
<th>t statistic</th>
<th>Significant value</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>KP = 0.23 KI + 0.70 PN</td>
<td>5.10</td>
<td>Significant</td>
<td>77%</td>
</tr>
</tbody>
</table>

Based on table 2 and table 3 above, the impact of Value Creation (\( \text{Penciptaan Nilai/PN} \)) to Marketing Performance (\( \text{Kinerja Pemasaran/KP} \)) is higher than the Impact of Innovation Capability (\( \text{Kapabilitas Inovasi/KI} \)) to Marketing Performance (\( \text{Kinerja Pemasaran/KP} \)) with total impact of 77%. While the indirect impact Impact of Innovation Capability (\( \text{Kapabilitas Inovasi/KI} \)) to Marketing Performance
Performance (Kinerja Pemasaran/KP) through Value Creation (Penciptaan Nilai/PN) is 0.73*0.70=0.51. Thus, total impact of Innovation Capability (Kapabilitas Inovasi/KI) to Marketing Performance (Kinerja Pemasaran/KP) is 0.23+0.51=0.74.

CONCLUSION

1. Based on calculation, The value of $t_{\text{statistic}}$ on the variable of innovation capability is 9.33 higher than $t_{\text{critical}}$ of 1.96. Thus with 5% error rate, $H_0$ is rejected and $H_a$ is accepted. Therefore it can be concluded that partially, innovation capability has a positive influence of 53% to value creation. This result gives empirical evidence that a higher innovation capability will increase the value creation of the SMEs of knitting industry in Bandung.

2. Based on calculation, The value of $t_{\text{statistic}}$ on the variable of innovation capability is 9.76 higher than $t_{\text{critical}}$ of 1.96. Thus with 5% error rate, $H_0$ is rejected and $H_a$ is accepted. Therefore it can be concluded that innovation capability has a positive influence of 34% to marketing performance. This result gives empirical evidence that a higher innovation capability will increase the marketing performance of the SMEs of knitting industry in Bandung.

3. Based on calculation, the value of $t_{\text{count}}$ on the variable of value creation is 8.73 higher than $t_{\text{critical}}$ of 1.96. Thus with 5% error rate, $H_0$ is rejected and $H_a$ is accepted. Therefore it can be concluded that value creation has a positive influence of 57% to marketing performance. This result gives empirical evidence that a higher value creation will increase the marketing performance of the SMEs of knitting industry in Bandung.

4. Based on calculation, the value of $t_{\text{statistic}}$ on the indirect impact of the variable innovation capability is 5.10 higher than $t_{\text{critical}}$ of 1.96. Thus with 5% error rate, $H_0$ is rejected and $H_a$ is accepted. Thus, it can be concluded that innovation capability has indirect impact of 77% to marketing performance of the SMEs of knitting industry in Bandung through value creation.

5. The findings in this research gives empirical evidende of a positive and significant impact of innovation capability and value creation as the exogenous latent variables to marketing performance as the endogenous latent variable. That eventually provides a basis for the SMEs at the center of knitting industry in Bandung to improve their marketing performance by increasing the value creation through the enhancement of their innovation capability.

This paper is expected to contribute to the literature with the establishment of a conceptual framework models that are customized to the phenomena that occur in the knitting center at Bandung city (Indonesia) particularly in Binong Jati and Margasarri areas. The weak innovation capability of knitting entrepreuners makes the lack of value creation for the customer, which of course will have impact on the marketing performance of knitting products. The research model framework is built upon a causal link both form the internal of SMEs itself and from the external environment that affect the company business, especially SMEs. To clarify the causal relation that happens, the research model is built from a combination of several posts related to the innovation capability, value creation and marketing performance. Some indicators of innovation capability variables that are designed are adjusted to the conditions of SMEs in the knitting industry at Binong Jati and Margasarri and the author consideration.

Therefore, the writer suggest the entrepreneurs at the center of knitting industry in Bandung to improve their innovation capability by improving the leadership of the entrepreneurs through the openness of new ideas so that developing a friendly climate and culture for the improvement of innovation capability, developing the ability to absorb various information as well as technology, thus increasing the creativity in creating both superior products and methods compare to their competitor in order to improve the marketing performance.

In addition, many studies models of previous author only discussed in general for large companies, although there are for SMEs but it has not been into the knitting industry business. The problems at knitting industry in Indonesia, especially Bandung is unique compared to another existing SMEs industry, thatin the future, it is expected atesting to be conducted to similar industryin order to be able to generalize the model in this research.
REFERENCES


Assessment of Occupational Burnout among Nurses Work at Critical Care Units in Al Najaf Governorate

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** M.B.ch. B FIMS

Abstract- The current descriptive cross-sectional study aimed to assess Occupational Burnout among Nurses Work at Critical Care Units, as well as, to find any significant relation for Nurses socio-demographic characteristic with a state of physical fatigue and mental exhaustion result from the occupational Burnout. Therefore, by using SPSS a simple Non-Probability (convenience Sample) of nurses who are working at the critical care units, and then (270) nurses were selected randomly. The findings of the present study indicated that the overall assessment of Nurses’ occupational Burnout are moderate to high. In addition, the overall assessment of the sources of nurses’ occupational burnout are partially affected. In addition, there is indicated a non-significant association between the nurses’ occupational burnout and their demographic data, except with their gender, years of experience, and visits to psychiatrist, there is a significant association.

Index Terms- Occupational Burnout, Nurses, Critical Care Unites, Mental Exhaustion

I. INTRODUCTION

Nursing is one of the professions and is specifically vital in the medical and mental health care delivery. Nurses are involved in the various units of the hospital administration as clinical staff and the nature of their work make them highly vulnerable to burnout syndromes (1). Nursing may involve issues such as prolonged direct personal contact of an emotional nature with a large number of patients, role ambiguity, responsibility for other’s live, work overload, shift work, staff issues, overtime, low salaries and lack of opportunities for advancement (2). These issues may create some mismatch between the realities of the job and the individual’s expectations which may in turn lead to frustration, disappointment and a feeling of dissatisfaction; a tendency that is often linked with decreased productivity, loss of confidence and negative behavioral changes which are harmful to the individual, organization and their clients (3,4).Organizational factors that can lead to job burnout are management style, inflexible rules of job, lack of job security and few opportunities for promotion World Health Organization, (5) (MOH). Based on the utilization of the concept in peer reviewed publications, Burnout was measured using the Maslach Burnout Inventory-Human Services Survey (MBI-HSS), which is a 22- item scale designed to measure 3 dimensions of burnout: emotional exhaustion, depersonalization, and personal accomplishment, a high level of burnout is indicated by high scores on the emotional exhaustion and depersonalization subscales and low scores on the personal accomplishment, while the last part included of the questionnaire is comprised of (5) domains, including the Lack of control, lack social relationship, work overload, values conflict, and insufficient reward. All of these domains are measured the five-point Likert scale.

Objectives of the Study:

- This study aimed to assess Occupational Burnout among Nurses Work at Critical Care Units in Al Najaf Governorate.
- and also, to find out the relationship between occupational burnout among nurse’s work and their socio demographic data

Methodology:

- By using a descriptive design, a cross-sectional study was carried out with analytic utility. A self-administered questionnaire composed of three parts was used, the first part included inquiry regarding socio-demographic characteristic of participants, and the second part included questions concerning Burnout was measured using the Maslach Burnout Inventory-Human Services Survey (MBI-HSS), which is a 22- item scale designed to measure 3 dimensions of burnout: emotional exhaustion, depersonalization, and personal accomplishment, a high level of burnout is indicated by high scores on the emotional exhaustion and depersonalization subscales and low scores on the personal accomplishment. The last part included of the questionnaire is comprised of (5) domains, including the Lack of control, lack social relationship, work overload, values conflict, and insufficient reward. All of these domains are measured the five-point Likert scale.

Sample Size and Sampling Technique:

- Sample size was calculated according to the standard equation cross-sectional studies was used, (11,12,13,10).in Al-Najaf Al-Ashraf Governorate Hospitals. The Nurses
with occupational burnout selected by simple random sampling technique, 270 nurses who are working at the critical care units were selected and provided with a self-administered questionnaire. The data collected from (2016-1-19) until (2016-4-5). Each subject expends around (20-25) min. as a maximum time to complete the questionnaire. Finally, only (270) questionnaires were acceptable for analysis due to missing or incomplete data.

Statistical Analysis:
By using statistical package for social sciences (SPSS), version 16. All the scale variables were normally distributed with small Skewness and Kurtosis in some variables. Appropriate statistical tests were used accordingly. P.value ≤ 0.05 considered significant difference or relationship.

II. RESULTS

Table (1): Socio-demographic characteristics of the Nurses’ (N = 270)

<table>
<thead>
<tr>
<th>Demographic Data</th>
<th>Rating And Intervals</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>122</td>
<td>45.2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>148</td>
<td>54.8</td>
</tr>
<tr>
<td>Social class</td>
<td>Married</td>
<td>152</td>
<td>56.3</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>114</td>
<td>42.2</td>
</tr>
<tr>
<td></td>
<td>Widowed</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td>Age / years</td>
<td>&lt;= 24.00</td>
<td>115</td>
<td>42.6</td>
</tr>
<tr>
<td></td>
<td>25.00 - 31.00</td>
<td>78</td>
<td>28.9</td>
</tr>
<tr>
<td></td>
<td>32.00 - 38.00</td>
<td>39</td>
<td>14.4</td>
</tr>
<tr>
<td></td>
<td>39.00 - 45.00</td>
<td>26</td>
<td>9.6</td>
</tr>
<tr>
<td></td>
<td>46.00+</td>
<td>12</td>
<td>4.4</td>
</tr>
<tr>
<td>Certification</td>
<td>Secondary school</td>
<td>84</td>
<td>31.1</td>
</tr>
<tr>
<td></td>
<td>Diploma in nursing</td>
<td>125</td>
<td>46.3</td>
</tr>
<tr>
<td></td>
<td>Bachelor in nursing</td>
<td>61</td>
<td>22.6</td>
</tr>
<tr>
<td>Experience</td>
<td>&lt;= 7.00</td>
<td>200</td>
<td>74.1</td>
</tr>
<tr>
<td></td>
<td>8-14</td>
<td>43</td>
<td>15.9</td>
</tr>
<tr>
<td></td>
<td>15-21</td>
<td>14</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>22-28</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>29 And More</td>
<td>5</td>
<td>1.9</td>
</tr>
<tr>
<td>Salary</td>
<td>Less than 500,000 ID</td>
<td>215</td>
<td>79.6</td>
</tr>
<tr>
<td></td>
<td>501,000-750,000 ID</td>
<td>47</td>
<td>17.4</td>
</tr>
<tr>
<td></td>
<td>751,000-1,000,000 ID</td>
<td>5</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>More than 1,000,000 ID</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>Official responsibility</td>
<td>1</td>
<td>5</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>38</td>
<td>14.1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>15</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>212</td>
<td>78.5</td>
</tr>
<tr>
<td>Unit</td>
<td>Emergency</td>
<td>105</td>
<td>38.9</td>
</tr>
<tr>
<td></td>
<td>Operation room</td>
<td>58</td>
<td>21.5</td>
</tr>
<tr>
<td></td>
<td>CCU</td>
<td>35</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>ICU</td>
<td>21</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>Hemodialysis</td>
<td>27</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Premature units</td>
<td>24</td>
<td>8.9</td>
</tr>
<tr>
<td>Residency</td>
<td>Urban</td>
<td>235</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>35</td>
<td>13</td>
</tr>
<tr>
<td>Shift</td>
<td>Morning</td>
<td>231</td>
<td>85.6</td>
</tr>
<tr>
<td></td>
<td>Night</td>
<td>39</td>
<td>14.4</td>
</tr>
<tr>
<td>Physical illness</td>
<td>Yes</td>
<td>35</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>235</td>
<td>87.0</td>
</tr>
<tr>
<td>Visits Psychiatrist</td>
<td>Yes</td>
<td>5</td>
<td>1.9</td>
</tr>
</tbody>
</table>
A total of 270 nurses were enrolled in this study, with a mean age less than or equal (24) years. Majority of participants aged less than or equal 24 years. Females represented 54.8% of the studied group, (56.3%) were married. Regarding to the subject’s certification, the majority of study sample are, graduated from diploma in nursing (46.3%). The most of study sample have (<=7) years of experience (74.6%), (79.6%)of the participants had a monthly income less than 500 thousand IQD, while (17.4%) had an income of < 700,000 IQD the most of study sample official responsibility are (4) this main not have any official responsibility (78.5%), most of the study sample in related to their unit are work in emergency unit (38.9), the majority of the study sample are living in urban residential are (87%), the majority of the study sample are work in morning shift (87%), the results show that most of the study sample are no have disease (78%), the most of the study sample are no have any psychiatric problems (98.1%) .

### Table (2) Assessment of Nurses’ Occupational Burnout

<table>
<thead>
<tr>
<th>Studied Domains</th>
<th>Levels of Burnout</th>
<th>Freq.</th>
<th>Percent</th>
<th>m.s</th>
<th>assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional exhaustion</td>
<td>High</td>
<td>84</td>
<td>31.1</td>
<td>2.32</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>118</td>
<td>43.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>68</td>
<td>25.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depersonalization</td>
<td>High</td>
<td>202</td>
<td>74.8</td>
<td>2.59</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>51</td>
<td>18.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>17</td>
<td>6.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal accomplishment</td>
<td>Low</td>
<td>7</td>
<td>2.6</td>
<td>2.80</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>56</td>
<td>20.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>207</td>
<td>76.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>270</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

According to the current study outcomes the majority of the nurses expressed moderate emotional exhaustion burnout, high depersonalization burnout, and low personal accomplishment burnout. Moreove.

### Table (3) Assessment of the Sources of Nurses’ Occupational Burnout

<table>
<thead>
<tr>
<th>Studied Domain</th>
<th>Overall Assessment of Burnout Sources</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of control</td>
<td>Affected</td>
<td>155</td>
<td>57.4</td>
</tr>
<tr>
<td></td>
<td>Partially Affected</td>
<td>65</td>
<td>24.1</td>
</tr>
<tr>
<td></td>
<td>Unaffected</td>
<td>50</td>
<td>18.5</td>
</tr>
<tr>
<td>Lack social relationship</td>
<td>Unaffected</td>
<td>71</td>
<td>26.3</td>
</tr>
<tr>
<td></td>
<td>Partially Affected</td>
<td>163</td>
<td>60.4</td>
</tr>
<tr>
<td></td>
<td>Affected</td>
<td>36</td>
<td>13.3</td>
</tr>
<tr>
<td>work overload</td>
<td>Affected</td>
<td>73</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Partially Affected</td>
<td>119</td>
<td>44.1</td>
</tr>
<tr>
<td></td>
<td>Unaffected</td>
<td>78</td>
<td>28.9</td>
</tr>
<tr>
<td>Values conflict</td>
<td>Unaffected</td>
<td>141</td>
<td>52.2</td>
</tr>
<tr>
<td></td>
<td>Partially Affected</td>
<td>84</td>
<td>31.1</td>
</tr>
<tr>
<td></td>
<td>Affected</td>
<td>45</td>
<td>16.7</td>
</tr>
<tr>
<td>Insufficient reward</td>
<td>Affected</td>
<td>136</td>
<td>50.4</td>
</tr>
<tr>
<td></td>
<td>Partially Affected</td>
<td>72</td>
<td>26.7</td>
</tr>
<tr>
<td></td>
<td>Unaffected</td>
<td>62</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>270</td>
<td>100</td>
</tr>
</tbody>
</table>
Table (4) Overall Assessment of the Sources of Nurses’ Occupational Burnout

<table>
<thead>
<tr>
<th>Sources of nurses burnout</th>
<th>overall responses</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unaffected</td>
<td>63</td>
<td>23.3</td>
<td></td>
</tr>
<tr>
<td>Partially Affected</td>
<td>162</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Affected</td>
<td>45</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Additionally, the current findings demonstrate that the (60%) of the nurses' overall response to the sources of the nurses’ occupational burnout are partially affected.

Table (5) Relationship between Nurses’ Occupational Burnout and their Demographic Data

<table>
<thead>
<tr>
<th>Demographic Data</th>
<th>Rating And Intervals</th>
<th>Nurses’ Burnout</th>
<th>Total</th>
<th>Chi-Square Value</th>
<th>D.F.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>41</td>
<td>33</td>
<td>122</td>
<td>8.358</td>
<td>0.015 S</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>36</td>
<td>65</td>
<td>148</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>77</td>
<td>98</td>
<td>270</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Class</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td></td>
<td>42</td>
<td>53</td>
<td>152</td>
<td>2.802</td>
<td>0.591 NS</td>
</tr>
<tr>
<td>Single</td>
<td></td>
<td>33</td>
<td>43</td>
<td>114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Widowed</td>
<td></td>
<td>2</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>77</td>
<td>98</td>
<td>270</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age / Years</td>
<td>&lt;= 24.00</td>
<td>24</td>
<td>50</td>
<td>115</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.00 - 31.00</td>
<td>27</td>
<td>28</td>
<td>78</td>
<td>13.491</td>
<td>0.096 NS</td>
</tr>
<tr>
<td></td>
<td>32.00 - 38.00</td>
<td>15</td>
<td>9</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>39.00 - 45.00</td>
<td>9</td>
<td>9</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>46.00+</td>
<td>2</td>
<td>3</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>77</td>
<td>98</td>
<td>270</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate</td>
<td>Secondary school</td>
<td>17</td>
<td>34</td>
<td>84</td>
<td>7.668</td>
<td>0.105 NS</td>
</tr>
<tr>
<td></td>
<td>Diploma in nursing</td>
<td>45</td>
<td>38</td>
<td>125</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bachelor in nursing</td>
<td>15</td>
<td>26</td>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>77</td>
<td>98</td>
<td>270</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years Of Experience</td>
<td>&lt;= 7.00</td>
<td>52</td>
<td>80</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.01 - 14.00</td>
<td>16</td>
<td>14</td>
<td>43</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14.01 - 21.00</td>
<td>8</td>
<td>1</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21.01 - 28.00</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>28.01+</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>77</td>
<td>98</td>
<td>270</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>Less than 500,000 ID</td>
<td>58</td>
<td>80</td>
<td>215</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>501,000-750,000 ID</td>
<td>16</td>
<td>15</td>
<td>47</td>
<td>1.634</td>
<td>0.95 NS</td>
</tr>
<tr>
<td></td>
<td>751,000-1,000,000 ID</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>More than 1,000,000 ID</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>77</td>
<td>98</td>
<td>270</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibility</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>5.587</td>
<td>0.471 NS</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10</td>
<td>9</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>15</td>
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<tr>
<td></td>
<td>4</td>
<td>61</td>
<td>82</td>
<td>212</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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The current findings and results show that there is an insignificant relationship concerning the nurses’ occupational burnout and their demographic data, except with their gender, years of experience, and visits to psychiatrist.

III. DISCUSSION

The current study results show that the majority of the nurses are married female, this is consistent with the finding of Jordanian researchers (14), who found that more than half of participants from stressful areas were female. as well the Chinese researchers (15), who found that above sixty percent of respondents were married. this can be clarified by using of non-probability sampling by current study. In addition, dominant age of the sample is less than or equal (24) years. This result is compatible to the findings of Iranian research done in (16) who found that the majority of participants were below 30 years of age. Regarding to the subjects shift, the majority of nurses were working in morning shift, which disagreed with the results of Jordanian work done by (20) and found that majority of sample were working in night shift (20). As well, for participants’ disease, greatest proportion of them had no disease.

In addition, the majority of study sample in regarding to their psychiatric status, the study results indicate that they have no any psychiatric problems. As well as, the Iranian researchers (21), reached to the same outcome when they studied participant nurses burn out in relation to the job rotation. Consistently, they find that the majority of the study subjects are female, married, and have years of experience less than 10 years. While for the nurses who are working at the emergency units, this result comes because the emergency units characterized by a high number of clients so it requires a large number of nurses as compared with other units.

According to the current study outcomes the majority of the nurses expressed moderate emotional exhaustion burnout, high depersonalization burnout, and low personal accomplishment burnout. Moreover, the results show that the majority of the study subjects are exhibiting occupational burnout, and personal accomplishment is the dominant one. (21) find that the nurses who are working at the critical care units are suffering from occupational burnout and the personal accomplishment is the dominant occupational burnout which is consistent with the current study results (21). While, another work done by Embriaco and others agreed with current results, they found that the majority of critical unit staff (from nurses and doctors) expressed high level of burnout (22), this may refer to increasing in work stress among Iraqi health personnel which is similar to their counterparts in France.
The Canadian research conducted by (23) studied how to anticipating the dimensions of job burn out through the dynamic link among job control, self-determination for the job and job requirements. Totally, they find that the job control diminishes the unhealthy influence of job requirements in anticipating depersonalization and emotional exhaustion, precisely for personnel with higher stages of job self-determination.

The Romanian research by (24) studied the occupational burnout among medical workers, they studied both nurses and doctors in emergency department, ambulance and intensive care unit and the national survey result revealed that the vast majority of participants exhibited moderate to high level of burnout, on one hand, this is consistent with present findings where the mainstream of study sample possessed moderate to high level of burn out. While on the other hand, Popa and others almost agreed with our result, which they found that the nurses are suffering from occupational burnout and the most affected domains are the emotional exhaustion and the personal accomplishment.

The study results indicate that the study subjects’ overall responses to the sources of burnout are affected at the lack of control, values conflicts, and lack of positive reinforcement domains, while at the lack social relationship and work overload domains the study subjects’ responses are partially affected. Additionally, the current findings demonstrate that the (60%) of the nurses' overall response to the sources of nurses' occupational burnout are partially affected. From researcher point of view, the following issues are the reason that the respondents affected by most of sources of burnout. These reasons can be detailed as: there is no arrangement in nurses time; there is no harmony between nurses and patients, and visitors who are coming to work position, also nurses are subjects to work overload. As well, the traditions, norms and values of society can also affect negatively on the work and ethics of the workers. In addition, absence of rewarding and the insert good workers gives a bad impression; consequently, this affects the exerted efforts.

The current findings and results shows that there is an insignificant relationship concerning the nurses’ occupational burnout and their demographic data, except with their gender, years of experience, and visits to psychiatrist, the study results indicate that there is a significant relationship. (21), find that the nurses’ burnout was significantly related to their gender. (23), find that there is a significant relationship between the nurses’ burnout and their years of experience. While for the relationship with the visiting of psychiatrist, this results comes because that the burned nurses who do not visiting the psychiatrist are more vulnerable to have bad progressive burnout otherwise they may control on their burnout (23, 21).

IV. CONCLUSIONS AND RECOMMENDATIONS

The study concludes that the nurses’ gender, years of experience, and visiting of psychiatrist are affecting their perception of occupational burnout. The study recommends that an intensive wide-ranging population-based (national level) studies conducted to assess the nurses’ occupational burnout. How to decrease the levels of this type of burnout, programs of health education should be applied to increase knowledge of the nurses about the impact of their burnout on the job productivity and also to increase their awareness to how avoid and manage their burnout.

REFERENCES


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AUTHORS

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Second Author – Dr. Arafat. H AL-Dujaili, M.B.ch. B FIMS
THE APPLICATION OF PREDICTIVE ANALYTICS: BENEFITS, CHALLENGES AND HOW IT CAN BE IMPROVED

FATIMETOU ZAHRA MOHAMED MAHMOUD

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Abstract: In fact, with the big data spread and continuous increase analytical systems get more important role and necessity in organizations. Thus, Predictive analytics in general are used to detect the relationships and patterns in data in order to predict the future by analyzing the past and taking better preventive decisions. But, their purpose of use is varied from an industry to another. This paper, describes the purpose of predictive analytics use in many industries and how the predictive analytics have been used as a solution to solve many problems in different industries. The predictive analytics have many benefits such as reduce and prevent risk, save time, cost and better management of resources in addition to the ability to take better strategic decisions based on fact not on intuition. Furthermore, the research in the area show challenges such as to get real, sufficient and clean data to test models developed. Moreover, it illustrates the weaknesses in the research area such as the focus on the development of models only, the wrong choice of models variables and algorithms which affect the final results of predictions, and what can be improved in the future research.

Keywords: Predictive analytics, models, algorithms, industries, management tasks

I- INTRODUCTION

predictive analytics are defined as technologies and methods that allow organization to detect orientations and patterns in data, developing models, and testing a huge number of variables. The predictive analytics are used by organizations to achieve their
desired goals and increase their profits. Also, the research reports show that its estimated to have a grow in the predictive analytics market from $1.70 billion in 2013 to $5.24 billion in 2018 with CAGR rate of 25.2% [1].

II- LITERATURE REVIEW

II-1- predictive analytics

In order to introduce what is predictive analytics we need to know where it comes from. Thus, firstly the umbrella that covers those systems is called business intelligence (BI). Business intelligence is a combination of tools aiming to enhance the decision making in an organization by transforming data into beneficial information and knowledge which is extracted by utilizing data mining tools and analytical techniques. BI systems help in analyzing and improving organization's performance, creating new strategies to enhance the revenue and profit of the organization. Thus Data mining is part of Business intelligence functionalities as defined by Gartner who described BI as a software platform delivering 14 capabilities divided into three groups of functionalities including integration, information delivery and analysis functionality which contain the data mining and predictive modeling. While data mining is considered as the automated process to detect the unknown patterns in the structured data of the organization[2][3]. Another one [4] describes data mining as the process to collect, filter, prepare, analyze and store data that will be used to create useful knowledge and supporting the data analytics and predictive modelling. In fact, data analytics is divided into four types as follow:

- The descriptive analytics: which describe the current situation and answer the question what is happening now?
- The diagnostic analytics: which answer the question Why this is happening?
- The predictive analytics: which answer the question what will happen in the future?
- The prescriptive analytics: which answer the question what is the right choice or solution?

Actually, for the predictive analytics process it pass by five phases, the identification of the problem, the collection and preparation of the data, analysis of the data and the development of the model, the deployment, observation and control of the predictive model. Moreover, predictive analytics [5] can be defined as a prediction of the future by analyzing the past performance and studying the historical data to uncover the relationships and patterns in these data. While [6] add that the
predictive analytics help organizations' in predicting risk, tendency, and in attaining better revenues by enhancing their key metrics and making strategic corrections and this is by making accurate predictions from structured and unstructured information. Actually, those predictions are done based on models.

III- 2- Models and Algorithms used in predictive analytics

Thus, predictive models are creating during the predictive modelling process to discover the patterns between dependent variables and explanatory variables and predicting an outcome [6][7]. Various algorithms are used:

Classification: decisive outcome, it's for predicting the value of decisive variable (class or target) by constructing a model based on one or multi decisive or numerical variables (attributes or predictors).

Clustering (unsupervised learning): assigning observations into clusters, each cluster contains the similar observations and data. This process helps in discovering the unknown relationships in a dataset.

Association rules: to find important associations in the observations, which mean association rules find all item sets that have support greater than the minimum support and then using the large item sets to generate the desired rules that have confidence greater than the minimum confidence. An example of association rules application is market basket analysis which is a modelling technique that can be described simply as if a customer buys a specific set of items he will more or less probably buy another set of items.

Regression: numerical outcome, predicting the value of target (numerical variable) by constructing a model based on one or more predictors (numerical and categorical variables).

Actually, there are different families of these algorithms and different ways of measuring the error as show figure 1 below.
II -3- Application of predictive analytics in different industries

Predictive analytics in general are used to detect the relationships and patterns in data in order to predict the future by analyzing the past and taking better preventive decisions. Thus, the predictive analytics aim of use differ from one industry to another, for instance a marketer can use the predictive analytics to predict the customers’ response to an advertising campaign, or a product seller can use it to predict the movement of product prices, or it can be used to detect trends such as in banks if a manager wish to recognize the most profitable customers, or alert a credit card customer to a probable fraudulent charge. Thus the predictive analytics help in answering many questions such as What will happen if the demand of products decrease? Or if suppliers’ prices increase? What is the risk to lose money a new business? [8]

In fact, in the education sector as one of the important sectors the predictive analytics have been used for different purposes and by using different models and tools. For example, a study focus in behavioral analytics in university in order to
predict whether students are vulnerable to deviant ideologies which can lead to terrorism [9]. While, another study shows the necessity and benefit from using the predictive analytics in the educational sector which will help the educational institutions to increase the retention of student and enhancing their results and achievements. The researchers focused on the use of classification algorithms especially the decision tree to get better prediction results. The lack in this study is that it's not specific and not tested by real world data [10]. In the same industry, another research aimed by the use of a performance analytic methodology to predict the final students' performance in a specific course during the semester and mark the ones that will fail and have low performance in exams. The researchers used the decision tree algorithm to predict the students' final performance results. Actually, this research will be more beneficial by doing deeper analysis of discovering the students’ mistakes in the exams, their learning interactions with the educational system by using different algorithms such as association rule algorithm [11]. Moreover, [12] analyzed the students’ data in order to predict the drop out feature of students and discovering the main factors that influence the open sources dropping by students. Thus, to do this analysis the researchers applied feature selection algorithms by using WEKA tool and then classification algorithms. Thus, the results will be more accurate with the use of different algorithms such as association and clustering techniques.

Actually, predictive analytics have been used also in business and market in general and in different countries. For instance, one of the studies done on one of the governmental organizations in Singapore described the characteristics of the procurement dataset specifics and its implications on the future purchase problem and solve it by using Markov chains model. In fact, the aim of the study was to cover the greater portion of the future purchasing by predicting the larger number of requesters. To attain this goal some algorithms have been evaluated such as probability distribution analysis, simple random sampling, sequence analysis, and Markov chains. Although, after the test the best approach among the algorithms used was Markov chains but in general the results were unsatisfactory to be practically applied. Thus, for requesters where prediction was possible (accuracy > 0) Markov approach got 0.31 accuracy with 6.64% dataset coverage without clustering; and 0.26 accuracy with 34.27% coverage with clustering. In fact, the integration of clustering reduced the accuracy, but it notably assisted to make predictions for more
requesters. This research could get better results with the use of association rules algorithms in order to discover better the relation between the study variables [13].

In India, a study was done in the Indian green coffee supply chain to develop a multi criteria decision support system based on predictive analytics to help stakeholders having better purchases and the ability to take better sales decisions and knowing the requirements of the green coffee supply chain market. Thus, the system must be more dynamic due to rapid market changes [14].

Moreover, in the IT industry a study used predictive analytics to build a model that analyze the factors affecting the chances to loss or win the IT services deals for IT service providers. This study benefits could be to better take decisions for the preparation and allocation of needed resources, and the attributes of sales pursuit may give awareness to what to do to raise the chances to win sales pursuits in the future. The model developed have been applied in two ways, firstly in the beginning of prioritization of the validated deals in the list, thus the model was utilized to give and early ranking list of deals with the chances of winning. While, the second way to apply the model was by the ideal distribution of sales force to following deals in order to increase the sales revenue. Thus, the model be improved by providing online prediction of deal outcome during the sales pursuit process and it can be extended by integrating this predictive model in another optimization model to determine the ideal bidding price [15].

Additionally, predictive analytics have been widely used in manufacture sector. For instance, in one of the research in manufacturing in metal cutting industry aiming to predict power consumption by utilizing big data infrastructure, the researchers created a prototype system by utilizing open platform solutions comprising Hadoop Distributed File System (HDFS), MapReduce, and a machine-learning tool. The researchers adopt a data-driven analytic modeling approach based on feature vectors which are n-dimensional vectors of numerical or nominal features that classify a machining operation. But the lack in the study was to acquire real data and integrating the analytic systems and the big data infrastructure and the integration of optimization modeling [16].
Furthermore, in a different way of use in a study done in Pakistan the focus was to minimizing the loss of human life from the drone attack by predicting the future attack frequency and the prospective losses and injuries and its adoption by the government. The tool used to build the predictive models was the IBM SPSS, and the selection of the predictive algorithm needed and its parameters was automatic. Actually this study would get better results if the selection of algorithms was manual to get better accuracy [17].

Moreover, predictive analytics can be used in the social media by social media companies and benefit from social media data while, [18] show the importance to extract valuable information from the social media data and use it for the creation of predictive models. Thus, the framework created merge data from multi social media sources for the analysis and it integrate feature selection, similarity metrics and sentiment and trend analysis by using R, WEKA, D3 and JSON [18].

While, in a different sector the predictive analytics have been utilized in transportation, where researchers present a smart public transportation decision support system to predict the times of bus arrival in short and long term. Thus to attain this, the researchers used clustering model to detect the patterns of bus performance, then a real-time vehicle schedule commitment and prediction model to identify the time of bus arrival and irregular operations, then the approach have been empirically validated by utilizing real-world data. Thus the model show reduction error and improvement in predicting delay [19]. Furthermore, in another sector which is the stock market where the researchers created a model to optimize prediction of products and stock market indications. Thus this model allows to set the stock indications future values and trading of financial services which will allow investors to increase significantly their returns on investment and reduce the risk [20].
Finally, one of the important industries that use the predictive analytics is the healthcare sector. For instance, a study in an Australian hospital was designed to develop a framework and a prototype to benefit from the Business Analytics techniques in the context of oncology and cancer care [21].

II -4- Application of predictive analytics in management tasks

In fact, nowadays the predictive analytics have been used in the diverse administrative tasks in organizations. Actually, some organization now face the challenge of the rigidity of enterprise resource planning (ERP) systems to adjust to the changes in the process in the organization and there is a significant continuous increase in the amount of data in the ERP transactional systems. Thus, the emerge of predictive analytics in the ERP systems to analyze the data will be a beneficial way to discover the risks and opportunities for the organization. While, the goal of the research is to implement a predictive analytics framework to automate the operational decision making in ERP systems. Moreover, to handle the various stages and parameters of business frameworks some important models need to be used such as the Analytical Decision Management (ADM) decision services and Business Rules. The ADM model is utilized to produce weekly predictions for putting the sales aims, levels of production, and distribution plans in resource planning systems. In fact, the predictive analytics, ADM models, Business intelligence systems and optimization are usually used not for the strategic decisions but for tactical or operational purposes in short term. The table 1 below show different practices of ADM in organization to deal with business practices, regulations and policies [6].
The results of this research show an importance to choose rightly the variables used in the model in order to get better quality in the resulted predictions. While the limitation of this study is its focus in the tactical and short term decision without investigating the use of predictive analytics to improve and make strategic decisions [6].

In a different purpose and in order to enhance the organization productivity and reducing time of offering services, the business process prediction analytics are used widely. Thus, for organizations to meet the Service Level Agreements (SLAs) signed with the customers, it need to forecast event logs and processes, realize their patterns, and predicting the workflow time. In fact, this research focus on firstly developing a framework to simplify the emulation of prediction analysis techniques and business process; then secondly to create a prediction model Hidden Markov Model (HMM) to predict the time needed to complete of business processes by discovering the patterns on workflows present in the historical event logs; and a test prototype which integrate the architecture suggested and the prediction analysis techniques. Actually, in the first stage the researchers implemented 4 prediction techniques the regression model, descriptive statistics, annotated transition system and the hidden Markov model. But, after the test and evaluation of the 4 mentioned models the results show that hidden Markov model gives the higher prediction results accuracy when compared to other models that's why it has been adopted in this study. The limitations of this study is the focus on one parameter without taking into consideration other parameters that may affect the
business processes such as the capabilities and the readiness of computing and human resources. Furthermore, the suggested model need to be tested by using real world data to improve its accuracy and effectiveness [22].

Another research addresses the issue of disconnection, fragmentation and decentralization of the campaign management support systems (CMMS). Thus, this research aim is to list the requirement of a centralized campaign spreading and analytics systems with the ability to discover the multistage and cross-campaign weaknesses and assisting in campaign management. Indeed, the focus is to create a centralized campaign analytics which order synchronically all the actual campaigns in the organization and simplifying the comparison between different offers and operations across various product lines by utilizing a real time predictive modeling. Furthermore, to describe the intelligence phase in the predictive model a SEMMA (Sample, Explore, Modify, Model, and Assess) methodology was used it comprise a database, modelling expertise and statistical analysis methods. Another methodology called DEEPER (Design, Embed, Empower, Performance measurement, Evaluate and Retarget) was used to integrate the intelligent phase depicted by SEMMA and integrate it to the campaign management strategy. In fact, the development of predictive analytics systems gives organizations the opportunity to centralize the data sources and integration of the enterprise information and applications and delivering faster decision making by the real time data warehousing. But unfortunately, the current use of predictive analytics models still divided and fragmented into parts for each business unit. Indeed, a real life practice of the CMMS for instance in LinkedIn where the predictive analytic systems are utilized to raise the site traffic and the paid membership. Thus, they make messages personalization by utilizing the real time data. When performing campaigns, the analyses results of LinkedIn performance in “refresh, remodel or do nothing” decisions. Another example is Yahoo! Which follow the approach of multi-stage to campaigns with an “upper funnel,” and a “lower funnel” [1].

Moreover, currently the solution selling organizations pertain and get closer to customers by the assigned sales team which consist of team with different responsibilities and skills. Thus, research focus on developing a system for organizing the sales force designation by using predictive analytics that use mining technique on the historical sales data aiming to forecast the sales effect for any specific designation of sales teams to the accounts of customers and prescriptive analytics that use the model of
linear programming to compute the optimal designation which maximized the revenue. Thus, this system will help firstly in the designation of sales team to customer accounts, secondly it assists the sales managers in organizing the teams’ designations. Moreover, this proposed system had many operations and benefits to enhance the sales force designation such as the analysis of the history of sales force and What-if analysis of scenarios of sales force designation. The figure 2 below shows the different layers of the system development [23].

The first layer is the descriptive layer which indicate gaining perception from the historical data. The data used in this system is the historical sales opportunity records that are generating when a sales person sell a service or a specific product to a customer. Moreover, the historical data comprise diverse information about the customers, the products or services, and sales team
members. This data is then converted to significant metrics such as for instance the number of chances of a sales person in a particular industry and the win ratio of sales team. In addition, these metrics give the base to realize the predictive model in the second predictive layer where the metrics are calculated at a specific time and they are utilized as a predictor to make predictions for the target variable. Then this historical data can be employed to train and assess the predictive model performance and accuracy. In this model due to binary nature of the targeted variables the researchers had use the classification algorithms to train the machine learning models. For this, the classifier used to train data is multilayer perceptron neural networks which is employed to model the non-linear relationships. The, the last third layer is the prescriptive layer which make analytics to suggest decisions. The input data is obtained from the predictive model, then it computes the optimal designation the maximize the revenues. The gap in this research was the use data limited in time, amount and integrity which does not reflect the real effectiveness and efficiency of the developed system. And there was no test and assessment of the system performance [23].

While a different model was developed to predict the chances of success and failure of a project during and after its development. This, model benefit is that it can save and reduce many financial expenditures by predicting the software functionality before its integration and it assist the managers to take better decisions about the projects that can continue development and the one that must be cancelled. But this work still need improvements and tests to validate its efficiency [24].

While, a research reviews some techniques to predict the stock market movements. Thus, regression algorithms are known as beneficial tools for the time-series prediction and modelling. For this, a comparison of financial prediction ability was made between three regression algorithms which are the Decision tree regression, Support Vector regression, and Multiple Linear regression. Thus, to dot his evaluation of algorithms performance the experiments was done by utilizing the L’Oréal financial data. The results shown that Support Vector regression algorithm performed and make better predictions than other compared algorithms [7].

III- LITERATURE FINDINGS
The table 2 below show the usage of predictive analytics in term of sectors, the purpose of use and the most algorithms and tools applied.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Goals of PA use</th>
<th>Algorithms</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business/marketing</td>
<td>Marketer can use PA to predict the customers’ response to advertising campaign</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banks</td>
<td>To predict the most profitable customers or to alert credit card customer to a probable fraud</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business/sales</td>
<td>Product sellers can use PA to predict the movement of product prices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Predicting student abnormal behavior, Predicting students’ results, Predicting the performance of students in a specific course</td>
<td>Classification, Decision tree, Feature selection</td>
<td>WEKA</td>
</tr>
<tr>
<td>Governmental organizations</td>
<td>Predicting purchases</td>
<td>Markov chains model, Clustering</td>
<td></td>
</tr>
<tr>
<td>Supply chain</td>
<td>Predicting the requirement of green coffee supply chain market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT services providers</td>
<td>analyzing factors that affect the chance to win</td>
<td>predictive models and</td>
<td></td>
</tr>
<tr>
<td>Manufacture sector</td>
<td>Predicting the power consumption in a metal cutting industry</td>
<td>feature vectors n-dimensional vectors</td>
<td>Hadoop HDFS, Map reduce, Machine learning tool</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------------------------</td>
<td>--------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Aviation</td>
<td>predicting future attack frequency and the prospective losses and injuries</td>
<td>automatic selection of algorithms</td>
<td>IBM SPSS</td>
</tr>
<tr>
<td>Social media</td>
<td>analyzing sentiment and trend analysis by using social media data</td>
<td></td>
<td>WEKA, JSON, D3, R</td>
</tr>
<tr>
<td>Public Transportation</td>
<td>predicting the time of bus arrival</td>
<td>Clustering model</td>
<td></td>
</tr>
<tr>
<td>Stock market</td>
<td>optimizing prediction of products and stock market indications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthcare sector</td>
<td>benefiting from predictive analytics in oncology and cancer care</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Table 2 |

In the table 3 below we can see some of the problems in management and systems in organization that have been resolved through the application of predictive analytics

<table>
<thead>
<tr>
<th>Purpose of usage</th>
<th>Solution by the application of PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>the rigidity of enterprise resource planning (ERP) systems to adjust to the changes in the process in the organization</td>
<td>implement a predictive analytics framework to automate the operational decision making in ERP systems.</td>
</tr>
</tbody>
</table>
**Table 3**

<table>
<thead>
<tr>
<th>Enhancing the organization productivity and reducing time of offering services. to meet the Service Level Agreements (SLAs) signed with the customers</th>
<th>create a prediction model Hidden Markov Model (HMM) to predict the time needed to complete of business processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>the issue of disconnection, fragmentation and decentralization of the campaign management support systems (CMMS)</td>
<td>to create a centralized campaign analytics which order synchronically all the actual campaigns in the organization and simplifying the comparison between different offers and operations across various product lines by utilizing a real time predictive modeling.</td>
</tr>
<tr>
<td>To get closer to customers in the solution selling organizations by the assigned sales team</td>
<td>developing a system for organizing the sales force designation</td>
</tr>
<tr>
<td>Reducing financial expenditures</td>
<td>predict the chances of success and failure of a project during and after its development</td>
</tr>
<tr>
<td>Stock market movements</td>
<td>Predicting the stock market movements</td>
</tr>
</tbody>
</table>

In fact, from the previous studies in predictive analytics we can see the benefits of its application such as the reduce and the prevention of risk, it allows to manage the resources, reduce time, allow to make better decisions, and save costs. While, in the other hands many of the researches done about the predictive analytics which in majority focused on the creation and development of new models to enhance the use and results of predictive analytics application faced some challenges such as getting real, sufficient and clean data to be able to test their models and discover its effectiveness. In addition, some models did not get the desired results due to the wrong choice of algorithms and variables. Moreover, the models applied must be dynamic and the predictive analytics must be integrated with other organizations systems to get better results and benefits.

**IV- Conclusion**
Indeed, predictive analytics are systems that have been used in different industries for different purposes some get the desired results and others not. While most of the research focused on the development and creation of models. But, is this sufficient? What the predictive analytics systems application lack to be able to get better results and benefit more from its use? Many organizations don’t know what to do and where to start, those in the future work we will try to answer those question and focusing on how to apply predictive analytics systems.

V- References


[5]. HodaMoghimi, Stephen Vaughan, Steven McConche, NilminiWickramasinghe. “How Do Business Analytics and Business Intelligence Contribute to Improving Care Efficiency?”. 2016. 49th Hawaii International Conference on System Sciences


[8]. Hoda Moghimi, Stephen Vaughan, Steven McConche, Nilmini Wickramasinghe. “How Do Business Analytics and Business Intelligence Contribute to Improving Care Efficiency?”. 2016. 49th Hawaii International Conference on System Sciences


Investigation of Integral Bridge Effect under Dynamic Loading

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Abstract- In this study, the integral bridge with various span length of 40m, 50m, 60m and 70m non-skew and skew angle of 15°, 30°, 45° and 60° were designed, and modeled in SAP2000 software. The parameters investigated in this analytical study were skew angle, span length and stress reduction methods. The geometric dimensions of the Integral Bridge and the loading used were in compliance with AASHTO standard specifications. Static analysis and dynamic nonlinear time history analysis were performed to assess the seismic performance of integral bridge. The analysis results in terms of shears and bending stresses, axial force and deflection were checked by allowable stress method. Extreme stresses that exceed allowable limit were reduced by using six different stress reduction methods. The propose of this study was to analyze behavior of integral, skew angle, and to reduce extreme stress of integral bridge under dynamic loading. In skew angle bridge, cross frame member stress increase greatly as skew bridge tend to rotate during a seismic event, which can cause excessive transverse movement. MSE+HLAC method was the best stress reduction method for all non-skew and skew angle bridge. According to analysis result, integral bridge maximum skew angle can be extend up to 60° and span length up to 60 m can be extended using stress reduction method under extreme seismic loading.

Index Terms- Integral bridge, skew angle, stress reduction, static analysis, dynamic analysis

I. INTRODUCTION

Integral abutment bridges (IABs) have been used for decades in the United States. Their use reduces both construction and maintenance costs and remains in service for longer periods of time than conventional bridges with only moderate maintenance and occasional repairs. In addition, they exhibit good earthquake resistance. Integral abutment bridges can be described as bridges generally built with their superstructures integral with the abutments, and avoid expansion joints and movement bearings for the entire length of the superstructure. The skew angle can be defined as the angle between the normal to the centerline of the bridge and the centerline of the abutment or pier cap. Since skewed bridges tend to rotate during a seismic event, which can cause excessive transverse movement. Because relatively limited research has been conducted on integral abutment bridges this paper presents an analytical procedure for nonlinear time history analysis of non-skewed and skewed integral bridges subjected to near-field ground motions.

II. MODELLING INTEGRAL BRIDGE

Integral bridge with various span lengths, and various skew angles were considered in the analysis. Bridge with different skew angle of 15 degree, 30 degree, 45 degree and 60 degree were considered. The span length vary from 40 m, 50 m, 60 m and 70 m with 5 number of span each total span of 200 m, 250 m, 300 m and 350 m respectively. Steel plate girder were used for span 20-60 m, steel box girder were used for span 70m. Under steel girder concrete deck slabs with 16 m width to carry four lane vehicles were used. The girder and slab were carried by integral abutment and integral pier with cap and bored pile foundation. The bridges models were analyzed under static and dynamic loading. The proposed bridge location was Kalay Township, near Chindwin River. The size of integral abutment was 1.5x16.5x10m and 10 m, the cap beam 1.5x 16.5x 9m, the pier shaft 9@1.5m diameter 10 m height and bored pile 9@1.5m diameter 31 m height. The steel plate girders were continuous and monolithic with abutment wall and piers bear on cap and piles foundation.

Figure 1: Modelling of integral bridge

Figure 2: Description of skew angle
III. DESIGN CRITERIA

Neither the AASHTO-LRFD Specifications nor the AASHTO-Standard Specifications contain detailed design criteria for integral abutments. In the absence of universally accepted design criteria, many states have developed their own design guidelines. These guidelines have evolved over time and rely heavily on past experience with integral abutments at a specific area. Criteria for integral abutments is such that maximum Span Length for Steel Bridge is 40m, total Bridge Length is 200m, and Skew angle is 45°. Department of Transportation in Colorado limit the maximum bridge length was 195m for steel bridge, 240m for concrete. Tennessee limit that 152 m for steel bridge, 244 m for concrete. Ontario, Canada limit that 100 m for steel and concrete bridge. Washington limit that 91 m for steel bridge, 125 m for concrete. It is noteworthy that concrete bridges are more recommended than steel bridge as integral structure.

IV. MATERIAL SPECIFICATION

The table show material specification used for concrete member in the analysis. Firstly, normal weight concrete was used in the analysis without stress reduction method. High performance concretes and high performance lightweight concretes were used as stress reduction method mention in article VI. C and D.

Table 1: Material specification

<table>
<thead>
<tr>
<th>Normal Weight Concrete</th>
<th>High Performance Concrete</th>
<th>High Performance Lightweight Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>E (Psi)</td>
<td>3604997</td>
<td>4029888</td>
</tr>
<tr>
<td>Poisson ratio, v</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Unit weight, r (lb/ft³)</td>
<td>145</td>
<td>150</td>
</tr>
<tr>
<td>Compressive / Tensile strength , Fc'/ (ksi)</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Allowable concrete bending stress, Fca (Psi) = 0.25 Fc</td>
<td>1080</td>
<td>4060</td>
</tr>
<tr>
<td>Allowable concrete bending stress, Fca (Psi) = 0.25 Fc'</td>
<td>1080</td>
<td>4060</td>
</tr>
<tr>
<td>Allowable concrete shear stress, Fsa (Psi) = 0.05 Fc</td>
<td>240</td>
<td>609</td>
</tr>
</tbody>
</table>

V. ANALYSIS PROCEDURE DESIGN CRITERIA

In this study, the integral bridge with non-skew and skewes were design and modeled in SAP2000 with vary span length. Then, applied loading such as dead load, changes in temperature, wind load, breaking load, high speed moving load, and seismic load in additional to gravity loads, earth pressure and surcharge load. In step I, the geometry of integral bridge with vary span length and skew angels were designed and check the structure stability. The boundary condition of the connection between abutment-back fill and soil-pile interaction were calculated as nonlinear spring stiffness. Then input static and dynamic loading were calculated. In step II, model the integral bridge with boundary condition and input loading. In step III, static analysis were performed using static load combination to study effect of integral bridge and skew angle, then check bending and shear stress, axial force and deflection under allowable stress method. If the bridge structure was not satisfy with allowable stress method redo step I, step II and step III until the bridge structure were stable under static loading. In step IV, dynamic nonlinear time history analysis were performed using seismic load then check bending and shear stress, axial force and deflection under allowable stress method. If the bridge structure was not satisfy with allowable stress method, calculate and input stress reduction method to reduce excessive stress, axial force and displacement and redo step IV until the bridge structure were satisfy under dynamic loading. By this way do for vary span length and skew angle. After the analysis finished, we can extend span length and skew angle of integral bridge under extreme seismic loading by using the best stress reduction method.

VI. STRESS REDUCTION METHOD

In the analysis, to reduce stress, moment and shear in integral bridge component, six different stress reduction methods were used.

A. Mechanically Stabilized Earth or MSE wall behind Abutment

Mechanically, stabilized earth or MSE is soil constructed with artificial reinforcing. Use of MSE walls with inextensible reinforcements was, and still is, performed by assuming the MSE structure behaves as a rigid body, to resist external loads applied by the retained soil and by any surcharge. MSE wall is used to reduce moment due to displacements in both lateral directions and to reduce bridge lateral displacement. The mechanically stabilized earth wall is located under bridge deck in front of the embankment.

B. Used of Sand Pile around Pile Foundation

Using sand Pile around foundation pile improve load bearing capacity and control settlement of piles. The stress displacement of footing rested on soft soil layer, significantly decrease the settlement. The displacement of foundation induces stress on integral abutment and pier. Therefore, the bearing capacity failure mechanism of footing rested on soft clay can be modified.
from exclusive settlement to general bearing capacity failure at the tip of confined replaced sand column. The bridge soil layer was upgraded by using 0.2 meter diameter sand pile is driven with spacing of 0.3 meter around foundation piles that produce sand layer. In the analysis, the sand layers around foundation piles were modelled as a spring model in axial and longitudinal direction. The spring stiffness values are calculated based on sand layer properties. Then, spring stiffness values are applied to pile foundation model.

C. Application of High Performance Light weight Aggregate Concrete, HLAC

In general, dead load is the major load in design of bridges; especially self-load of deck/girder often takes largest share in all the primary loads. Lightweight aggregate concrete is one of the most effective solutions to extend the application of integral bridges, if it can clear the durability and cost requirements. The lightweight aggregate concrete bridges have been rarely constructed in Japan because of its scant frozen-thawed resistance. High performance lightweight concrete (HLAC) means the concrete has higher frozen-thawed resistance than conventional concrete.

D. Application of High Performance Normal weight Concrete, HPC

High performance concrete has the main properties such as high strength, high workability, high durability, ease of placement, compaction without segregation, early age strength, long-term mechanical properties, permeability, density, and heat of hydration, toughness, volume stability, and long life in several environments.

E. Used of Extended Approach Slab in front of Abutment

In general, Bridges with integral abutments were constructed in the past with and without approach slabs. Traffic and seasonal movements of the integral abutments cause the fill behind the abutment to shift and to self-compact. This often caused settlement of the pavement directly adjacent to the abutment then induced stress to abutment and foundation pile. In addition, the approach slab bridges cover the area where the fill behind the abutment settles due to traffic compaction and movements of the abutment. It also prevents undermining of the abutments due to drainage at the bridge ends. In the analysis, 10 m length and 16 m width extended approach deck slab with 0.2 m thickness was provided at both end of the bridge deck slab without expansion joint.

F. Used of Elasticized Expanded Polystyrene EPS closing around Abutment or Pier

Expanded Polystyrene, EPS, geofoam is a super–lightweight, closed cell, rigid, plastic foam. Geofoam has now been successfully utilized in a number of countries all over the world. Integral abutment issue of special interest is the effect of EPS material. This was investigated by analysing a case with elasticized EPS, horizontal moment and stress on the abutment and pier is about nine times smaller. Use of EPS geofoam has the advantages such as to provide restraint against progressive and excessive displacement of bridge, to distribute movements to both abutments and thereby reduce maximum stress, forces, and moments, to reduce maximum earth pressure behind abutment, to reduce shear loads in dowels. In the analysis, EPS geofoam is used as a cover sheet to the abutment wall, the pier shaft and cap.

VII. ANALYSIS RESULT

Static and dynamic analysis were performed for bridge span 40, 50, 60 and 70 m with vary skew angle 15°, 30°, 45°, 60°.

A. Static Analysis Result

Static analysis stress result for 40m, 50m, 60m and 70 m span with non-shear and skew angle15°, 30°, 45° and 60° were shown in figure 4-8. For span 40-60 m, under static loading, bending and shear stress at all bridge component members were not greatly change with skew angle or without skew angle. All stresses are within allowable limit, thus the bridge structure is stable. For span 70 m, under static loading, bending and shear stress at all bridge component members except steel girder were not greatly change with skew angle or without skew angle. Steel girder stresses increase in skew angle 15°, 30°, then decrease skew 45°, 60°. Abutment and steel girder stresses were not within allowable limit for all skew and non-skew angles, thus the bridge structure was not stable.

As shown in figure 9, abutment and pier pile axial force increase in skew angle and span length increase. All abutment and pier pile axial forces were within allowable limit.

Figure 4: 40 M Span Bridge Stress Result under Static Analysis

Figure 5: 50 M Span Bridge Stress Result under Static Analysis

Figure 6: 60 M Span Bridge Stress Result under Static Analysis
As shown in table 2, 40 m span steel girder and bored piles displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 3, 50 m span all bridge member displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 4, 60 m span all bridge displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 5, 70 m span all bridge member displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 6, 70 m span all bridge member displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in figure 10, steel girder displacement increase in span length increase. Abutment bored pile displacement increase in span length increase. Other member displacements do not greatly change in span increase.

As shown in table 2, 40 m span steel girder and bored piles displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 3, 50 m span all bridge member displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 4, 60 m span all bridge displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 5, 70 m span all bridge member displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in figure 10, steel girder displacement increase in span length increase. Abutment bored pile displacement increase in span length increase. Other member displacements do not greatly change in span increase.

As shown in table 2, 40 m span steel girder and bored piles displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 3, 50 m span all bridge member displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 4, 60 m span all bridge displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in table 5, 70 m span all bridge member displacement decrease in skew angle increase. Abutment and abutment bored pile rotate in opposite direction to other member. All displacements were within allowable limit. As shown in figure 10, steel girder displacement increase in span length increase. Abutment bored pile displacement increase in span length increase. Other member displacements do not greatly change in span increase.
Table 7: Shear Stress Result for 40 M Span Non-skew and Skew Bridge under Dynamic Analysis (Ksi)

<table>
<thead>
<tr>
<th>Case / Skew angle</th>
<th>Abutment</th>
<th>Abutment bored pile</th>
<th>Pier cross beam</th>
<th>Pier cap</th>
<th>Pier bored pile</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>0.25</td>
<td>0.29</td>
<td>0.0001</td>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>15°</td>
<td>0.25</td>
<td>0.29</td>
<td>0.53</td>
<td>0.22</td>
<td>0.2</td>
</tr>
<tr>
<td>30°</td>
<td>0.25</td>
<td>0.33</td>
<td>0.71</td>
<td>0.29</td>
<td>0.26</td>
</tr>
<tr>
<td>45°</td>
<td>0.29</td>
<td>0.43</td>
<td>0.46</td>
<td>0.21</td>
<td>0.33</td>
</tr>
<tr>
<td>60°</td>
<td>0.46</td>
<td>0.74</td>
<td>0.39</td>
<td>0.2</td>
<td>0.53</td>
</tr>
</tbody>
</table>

As shown in Table 8-9, 50 m span bridge girder, abutment, abutment bored pile, pier bored pile stresses were not satisfy within allowable limit for all non-skew and skew angle bridge. Abutment cap, pier cross beam and pier cap stresses were increase as skew angle increase. Abutment cap stresses were not satisfied within allowable limit for skew angle 30°-60°. Pier cross beam stresses were not satisfy for all skew angle. Pier cap stresses were not satisfied from skew 45°. Stresses must be reduced to obtain within allowable limit by using stress reduction method.

Table 9: Shear Stress Result for 50 M Span Non-skew and Skew Bridge under Dynamic Analysis (Ksi)

<table>
<thead>
<tr>
<th>Case / Skew angle</th>
<th>Gr</th>
<th>AB</th>
<th>AB CAP</th>
<th>AB BP</th>
<th>P CB</th>
<th>P CAP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>46.3</td>
<td>4.6</td>
<td>8.3</td>
<td>0.2</td>
<td>0.0</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>15°</td>
<td>46.6</td>
<td>30.1</td>
<td>6.1</td>
<td>1.2</td>
<td>0.4</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>30°</td>
<td>40.9</td>
<td>11.1</td>
<td>5.8</td>
<td>2.3</td>
<td>946</td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>45°</td>
<td>33.3</td>
<td>11.1</td>
<td>4.5</td>
<td>3.3</td>
<td>1.3</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>60°</td>
<td>19.0</td>
<td>1.3</td>
<td>1.6</td>
<td>5.8</td>
<td>4.3</td>
<td>5.4</td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 10-11, 60 m span bridge girder, abutment, abutment bored pile, pier bored pile stresses were not satisfy within allowable limit for all non-skew and skew angle bridge. Abutment cap, pier cross beam and pier cap stresses were increase as skew angle increase. Abutment and pier cap stresses were not satisfy within allowable limit for skew angle 45°-60°. Pier cross beam stresses were not satisfy for all skew angle. Stresses must be reduced to obtain within allowable limit by using stress reduction method.

Table 10: Bending Stress Result for 60 M Span Non-skew and Skew Bridge under Dynamic Analysis (Ksi)

<table>
<thead>
<tr>
<th>Case / Skew angle</th>
<th>Gr</th>
<th>AB</th>
<th>AB CAP</th>
<th>AB BP</th>
<th>P CB</th>
<th>P CAP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>56.3</td>
<td>3.7</td>
<td>6.7</td>
<td>0.0</td>
<td>0.0</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td>15°</td>
<td>53.1</td>
<td>3.3</td>
<td>6.7</td>
<td>1.3</td>
<td>0.0</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>30°</td>
<td>46.5</td>
<td>2.4</td>
<td>6.1</td>
<td>2.5</td>
<td>0.0</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>45°</td>
<td>33.6</td>
<td>2.3</td>
<td>4.2</td>
<td>3.6</td>
<td>0.0</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>60°</td>
<td>19.8</td>
<td>1.3</td>
<td>6.7</td>
<td>4.7</td>
<td>0.0</td>
<td>6.2</td>
<td></td>
</tr>
</tbody>
</table>

Table 11: Shear Stress Result for 60 M Span Non-skew and Skew Bridge under Dynamic Analysis (Ksi)

<table>
<thead>
<tr>
<th>Case / Skew angle</th>
<th>Gr</th>
<th>AB</th>
<th>AB CAP</th>
<th>AB BP</th>
<th>P CB</th>
<th>P CAP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>10.1</td>
<td>11.8</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>15°</td>
<td>8.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>30°</td>
<td>7.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>45°</td>
<td>5.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>60°</td>
<td>3.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

As shown in Table 12-13, 70 m span bridge girder, abutment cap, pier cap and pier bored pile stresses were not satisfy within allowable limit for all non-skew and skew angle bridge. Stresses must be reduced to obtain within allowable limit by using stress reduction method.

Table 12: Bending Stress Result for 70 M Span Non-skew and Skew Bridge under Dynamic Analysis (Ksi)

<table>
<thead>
<tr>
<th>Case / Skew angle</th>
<th>Gr</th>
<th>AB</th>
<th>AB CAP</th>
<th>AB BP</th>
<th>P CB</th>
<th>P CAP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>3.9</td>
<td>7.2</td>
<td>0.0</td>
<td>0.0</td>
<td>9.1</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>15°</td>
<td>4.4</td>
<td>1.1</td>
<td>0.07</td>
<td>0.01</td>
<td>10.2</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>30°</td>
<td>6.5</td>
<td>1.6</td>
<td>0.07</td>
<td>0.01</td>
<td>10.1</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>45°</td>
<td>5.7</td>
<td>1.5</td>
<td>4.2</td>
<td>1.2</td>
<td>11.8</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>60°</td>
<td>4.1</td>
<td>1.3</td>
<td>0.5</td>
<td>0.03</td>
<td>21</td>
<td>4.1</td>
<td></td>
</tr>
</tbody>
</table>
Allowable bearing capacity of pile axial force was 838 ton calculated from soil condition. As shown in Table 15-16, allowable bearing capacity of pile axial force was 838 ton. Displacements were within allowable limit. As shown in figure 15-16, all displacement increase in skew angle increase. All displacements were within allowable limit.

Table 13: Shear Stress Result for 70 M Span Non-skew and Skew Bridge under Dynamic Analysis (Ksi)

<table>
<thead>
<tr>
<th>Skew angle</th>
<th>Gr</th>
<th>AB</th>
<th>P</th>
<th>P</th>
<th>P CAP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>0.1</td>
<td>0.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>15°</td>
<td>0.3</td>
<td>0.06</td>
<td>0.02</td>
<td>0.0</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>30°</td>
<td>0.2</td>
<td>0.2</td>
<td>0.02</td>
<td>0.02</td>
<td>0.8</td>
<td>0.2</td>
</tr>
<tr>
<td>45°</td>
<td>0.25</td>
<td>0.05</td>
<td>0.0</td>
<td>0.6</td>
<td>0.1</td>
<td>0.25</td>
</tr>
<tr>
<td>60°</td>
<td>0.3</td>
<td>0.1</td>
<td>0.09</td>
<td>0.0</td>
<td>1.1</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Table 14: Abutment Pile Axial Force Check

<table>
<thead>
<tr>
<th>Skew angle</th>
<th>40m</th>
<th>50m</th>
<th>60m</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>12</td>
<td>O.K</td>
<td>61</td>
</tr>
<tr>
<td>15°</td>
<td>176</td>
<td>O.K</td>
<td>1037</td>
</tr>
<tr>
<td>30°</td>
<td>325</td>
<td>O.K</td>
<td>1212</td>
</tr>
<tr>
<td>45°</td>
<td>441</td>
<td>O.K</td>
<td>1250</td>
</tr>
<tr>
<td>60°</td>
<td>659</td>
<td>O.K</td>
<td>1679</td>
</tr>
</tbody>
</table>

Table 15: Pier Pile Axial Force Check

<table>
<thead>
<tr>
<th>Skew angle</th>
<th>40m</th>
<th>50m</th>
<th>60m</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>13</td>
<td>O.K</td>
<td>1</td>
</tr>
<tr>
<td>15°</td>
<td>1045</td>
<td>Not O.K</td>
<td>911</td>
</tr>
<tr>
<td>30°</td>
<td>1884</td>
<td>Not O.K</td>
<td>1740</td>
</tr>
<tr>
<td>45°</td>
<td>1909</td>
<td>Not O.K</td>
<td>2213</td>
</tr>
<tr>
<td>60°</td>
<td>1699</td>
<td>Not O.K</td>
<td>1679</td>
</tr>
</tbody>
</table>

Figure 15: 40 and 50 m Span Bridge Displacement under Non Linear Time History Analysis

Figure 16: 60 and 70 m Span Bridge Displacement under Non Linear Time History Analysis

C. Dynamic Analysis Result using Stress Reduction Method

Using stress reduction method, checking stress result satisfy with allowable limit for 40 m span non-skew and skew angles bridge were shown in table 16. Non-skew bridge abutment and abutment bored pile force can reduce only by MSE+HLAC method; pier bored pile force can reduce by both MSE and MSE+HLAC method; abutment stress can reduce only MSE+HLAC method. For 15° skew bridge, abutment, abutment bored pile and pier bored pile force can reduce by MSE and MSE+HLAC method; pier cross beam forces can reduce by MSE, MSE+HLAC, HPC and Ex Slab method. For 40 m span 30° skew bridge, abutment and pier bored pile force can reduce only MSE+HLAC method; abutment bored pile force can reduce by MSE and MSE+HLAC method; pier cross beam forces can reduce by MSE, MSE+HLAC and HPC method. For 45° skew bridge, abutment and pier bored pile forces can reduce by HLC and MSE+HLAC method; abutment bored pile forces can reduce by MSE, MSE+HLAC and HPC method; pier cross beam forces can reduce by MSE and MSE+HLAC method; pier bored pile forces can reduce by MSE+HLAC method; pier cap force can reduce by all method except EPS method.

Table 16: 40 M SPAN, Check Stress Result Using Stress Reduction Method with Allowable Limit

<table>
<thead>
<tr>
<th>Non-Skew Bridge</th>
<th>AB</th>
<th>AB BP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>MSE</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>HPC70</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>Ex slab</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>MSE</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>Sand pile</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>HLC</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>HPC70</td>
<td>O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>Ex slab</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>EPS</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>MSE</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>Sand pile</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>HLC</td>
<td>O.K</td>
<td></td>
<td>not O.K</td>
</tr>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>HPC70</td>
<td>O.K</td>
<td></td>
<td>O.K</td>
</tr>
<tr>
<td>Ex slab</td>
<td>not O.K</td>
<td></td>
<td>O.K</td>
</tr>
</tbody>
</table>

Using stress reduction method, checking stress result satisfy with allowable limit for 50 m span non-skew and skew angles bridge were shown in table 17. For non-skew bridge, abutment and abutment bored pile forces can reduce only MSE+HLAC method; pier bored pile force can reduce by MSE and MSE+HLAC method. For 15°skew bridge, abutment and
abutment bored pile stresses can reduce only MSE+HLAC method; pier bored stress can reduce by MSE and MSE+HLAC method; pier cross beam stresses can reduce by MSE, MSE+HLAC, HPC method. For 30° skew bridge, abutment and pier bored pile stresses can reduce only MSE+HLAC method; abutment bored pile and pier cross beam stresses can reduce by MSE and MSE+HLAC method. For 45° skew bridge, abutment and pier bored pile stresses can reduce by MSE+HLAC and HPC method; pier bored pile stress can reduce by MSE, MSE+HLAC and HPC method. For 60° skew bridge, abutment stress can reduce by Sand Pile, HLAC and MSE+HLAC method; abdomen bored pile stress can reduce by MSE, MSE+HLAC, HPC and Ex Slab method; pier bored pile stress can reduce by HPC and MSE+HLAC method; abdomen cap and pier cap stresses can reduce by all method except EPS method. For 60° skew bridge, abdomen stress can reduce by Sand Pile, HLAC and MSE+HLAC method; abdomen bored pile stress can reduce by MSE, MSE+HLAC, HPC and Ex Slab method; pier bored pile stress can reduce by HPC and MSE+HLAC method; abdomen cap and pier cap stresses can reduce by all method except EPS method; pier cross beam stress can reduce by MSE+HLAC and HPC method.

**Table 17: 50 M SPAN, Check Stress Result Using Stress Reduction Method with Allowable Limit**

<table>
<thead>
<tr>
<th>Method</th>
<th>Gr</th>
<th>AB</th>
<th>AB BP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSE</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td>O.K</td>
<td>O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>Ex slab</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Gr</th>
<th>AB</th>
<th>AB BP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSE</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td>O.K</td>
<td>O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>Ex slab</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Gr</th>
<th>AB</th>
<th>AB BP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSE</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td>O.K</td>
<td>O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>Ex slab</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
</tbody>
</table>

Using stress reduction method, checking stress result satisfy with allowable limit for 60 m span non-skew and skew angles bridge were shown in table 18. For non-skew bridge, abutment and abdomen bored pile stresses can reduce only MSE+HLAC method; girder stress can reduce by MSE and MSE+HLAC method; pier bored pile stress can reduce by MSE+HLAC and HPC method. For 15° skew bridge, girder stress can reduce by MSE, MSE+HLAC and Ex Slab method; abdomen and abdomen bored pile stress can reduce only MSE+HLAC method; pier bored pile stress can reduce by MSE and MSE+HLAC method; pier cross beam stress can reduce by MSE, MSE+HLAC and EPS method. For 30° skew bridge, girder stress can reduce by MSE, MSE+HLAC and Ex Slab method; abdomen and abdomen bored pile stresses can reduce only MSE+HLAC method; abdomen bored pile stress can reduce by MSE and MSE+HLAC method; pier cross beam stress can reduce by MSE, MSE+HLAC and HPC method; pier cap stress can reduce stress by all method except Ex Slab and EPS method. For 45° skew bridge, girder stress can reduce by stress can reduce by MSE, Ex Slab and MSE+HLAC method; abdomen stress can reduce by HLAC and MSE+HLAC method; abdomen cap and pier cap stresses can reduce by all method except EPS method; abdomen bored pile stress can reduce by MSE+HLAC method; abdomen and abdomen bored pile stresses can reduce only MSE+HLAC method; abdomen bored pile stress can reduce by MSE+HLAC method; abdomen cap and pier cap stresses can reduce by all method except EPS method; abdomen bored pile stress can reduce by MSE, MSE+HLAC and HPC method. For 45° skew bridge, abdomen stress can reduce by Ex Slab, HLAC and MSE+HLAC method, abdomen bored pile stress can reduce by MSE, MSE+HLAC and Ex Slab method; pier bored pile stress can reduce by HLAC and MSE+HLAC method; abdomen and abdomen bored pile stresses can reduce only MSE+HLAC method; abdomen bored pile stress can reduce by MSE and MSE+HLAC method; abdomen cap and pier cap stresses can reduce by all method except EPS method; abdomen cross beam stress can reduce by MSE+HLAC and HPC method.

**Table 18: 60 M SPAN, Check Stress Result Using Stress Reduction Method with Allowable Limit**

<table>
<thead>
<tr>
<th>Method</th>
<th>Gr</th>
<th>AB</th>
<th>AB BP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSE</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>HPC70</td>
<td>not O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Gr</th>
<th>AB</th>
<th>AB BP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSE</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>HPC70</td>
<td>not O.K</td>
<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Gr</th>
<th>AB</th>
<th>AB BP</th>
<th>P BP</th>
</tr>
</thead>
<tbody>
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<td>MSE</td>
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<td>not O.K</td>
<td>not O.K</td>
<td>O.K</td>
</tr>
<tr>
<td>MSE+HLAC</td>
<td>O.K</td>
<td>not O.K</td>
<td>not O.K</td>
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Using stress reduction method, checking stress result satisfy with allowable limit for 70 m span non-skew and skew angles bridge
were shown in table 19. For all non-skew and skew bridges, abutment stress cannot reduce by any method. For 45° skew bridge, girder and pier bored pile stresses cannot reduce by any method. Therefore, 70 m span integral bridge with or without cannot be extend.

Table 19: 70 M SPAN, Check Stress Result Using Stress Reduction Method with Allowable Limit

<table>
<thead>
<tr>
<th>Method</th>
<th>Gr</th>
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<tr>
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<td>Ex slab</td>
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VIII. CONCLUSION

In the analysis, to reduce stress, moment and shear in integral bridge component, six different stress reduction methods were used. Static and dynamic analysis were performed for bridge span 40, 50, 60 and 70 m with vary skew angle 15°, 30°, 45°, 60°.

A. Static Analysis Result

Bending and Shear stress were not greatly change with skew angle increase. Axial forces of pile increase in skew angle increase. Displacements decrease in skew angle increase. Abutment and Abutment Bored Pile rotate in opposite direction to other member. Steel Girder Stresses increase in Span Length increase. Other member stresses do not change in Span Length increase. Abutment and Pier Pile Axial Force increase in span length increase. Steel Girder and Abutment Bored Pile Displacement increase in Span length increase. Other member Displacements do not greatly change in Span increase. All Stress, Axial Force and Displacements were satisfied within allowable limit. Thus the bridge structure is stable under static analysis.

B. Dynamic Analysis Result

Maximum Bending Stress occurred at as increase order form girder, abutment bored pile, pier shaft, pier bored pile and abutment. Maximum Shear Stress occur at abutment bored pile, abutment and girder. Bending and Shear Stresses increase in Span Length increase. Abutment and Pier Pile Axial Force increase in span increase. Abutment bored pile and pier bored pile displacements decrease in span 50 then stable in span 60 increases in span 70. Steel girder stress ratio increase in span increase but decrease in skew increase.. Girder, abutment and pier shaft stresses decrease in skew angle increase, but increase at skew 60. Cross frame members such as abutment cap, pier shaft, pier cross beam and pier cap stresses increase greatly with skew angle increase. Abutment bored pile and pier bored pile stresses decrease in skew angle increase. All displacements decrease in skew angle increase. Abutment and Pier Pile Axial Force increase in skew angle increase.

C. Dynamic Analysis Result using Stress Reduction Method

MSE Method can reduce stress at Gr, P CAP and P BP above 45%, AB CAP, AB BP, P, P CB above 79%. Sand Pile Method can reduce stress at abutment cap, pier cap and pier bored pile around 90%; abutment bored pile and pier shaft above 62%. HLAC can reduce abutment bored pile and pier cap above 94%; abutment cap, abutment bored pile, pier shaft and pier cross beam above 62%, and Gr and AB above 16%. HPC can reduce all member stress except abutment above 20%. Ex Slab can reduce all member stress except AB above 66%. EPS can reduce only abutment cap stress 2%.

In conclusion, at skew angle bridge, cross frame member stress increase greatly as skewed bridges tend to rotate during a seismic event, which can cause excessive transverse movement. MSE+HLAC method is the best stress reduction method for all non-skew and skew angle bridge with span length 40m 50m and 60m. Maximum Skew Angle can be extended up to 60° for span 40-60m.

ACKNOWLEDGMENT

We extend our sincere thanks to all who contributed to preparing the instructions.

REFERENCES

[8] ASS100-2004 Bridge Design
[9] Ashebo DB, Chan THT, Yu L: Evaluation of dynamic loads on a skew box girder continuous bridge Part II:

www.ijsrp.org
The Influence of Credit Risk on Stock Returns

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Abstract- Pro-cyclicality of credit risk due to global systemic factors has precipitated unmatched volatilities of stock returns in the banking sectors leading huge losses for investors in the stock market. In Kenya, the trend of bank collapse due insider lending and spiraling non-performing loans continue to signal negative stock returns. The objective of this study was therefore to empirically examine the influence of credit risk on stock returns in commercial banks listed at Nairobi securities exchange. The study also sought to establish the moderating effect of bank size on the influence of credit risk on stock returns. The ratio of non-performing loans to gross loans and the ratio of loan loss provision were taken as independent variable with bank stock returns as dependent variable and bank size as a moderator variable. Annual secondary data was obtained for the period 2006-2015 with a purposive sample of 9 listed banks. Descriptive correlational research design was used. Generalized least square regression model established that ratio of non-performing loans to gross loans (NPG) was negatively significant to stock returns while the ratio of loan loss provisions (LLG) was positively significant to stock returns at 5% level of significance. Bank size was found to have a positive moderating effect on the influence of credit risk on stock returns. Overall, the study concluded credit risk influences stock returns at Nairobi Securities Exchange.

Index Terms- Credit risk, Stock returns, Non-performing loans, Loan loss Provisions, Bank Size

I. INTRODUCTION

Investors maximize wealth by making risk assessment and predictions based on the information available in the market. Earnings prospect forms major part of information and therefore determinants of earnings becomes element of focus for investors. Fundamental principles of risk returns tradeoff prescribes that investments with higher risk are associated with higher returns as reward premium for any extra risk undertaken (Cheng & Nasir, 2010). Banks and financial markets serve an intermediary role within which investors diversify and optimize their portfolio investments.

The significance of commercial banks to an economy is to link between funds surplus and deficit units. As banks intermediate, they face a series of financial risks which are detrimental to sustainability of a financial system in a country. Unmitigated financial risks in banks can be catastrophic to shareholder market value. The adverse effects of financial risk to shareholder market value can be described by the loss of investment value experienced during global financial crisis. To estimate with precision the extent of risk to be undertaken to maximize value is crucial for sustainable banks, economy and investor wealth (Cheng & Nasir, 2010). Credit risk singles as the most sensitive risk determining and growth of investment value in commercial banks (Kargi, 2011).

Credit risk is defined as the risk of default; it refers to obligor’s inability to meet his debt obligations (Der-Fen, 2005). The risk of default in banks has been associated with high appetite for lending, excessive credit extension and poor credit management practices. Banks with higher levels of credit risk are prone to systematic risk. Due to adverse effects of credit risk during the financial crisis, the Bank of International Settlement (2011) adopted Basel III accords to regulate and reduce impact of credit risk on banks. Banks with credible credit risk management mechanism such as securitization programs do not have their stock prices adversely affected on announcement of huge loans (Greuning & Bratanovic, 2009). Mwaurah (2013) established that credit risk for commercial banks in Kenya is determined by both systemic and firm specific factors. Macroeconomic factors such as inflation, interest rates, exchange rates and growth domestic product form the external environmental factors affecting loan pricing and ability to pay of the obligors. Internal factors such as efficient credit management practices and balanced appetite for credit risk determine the asset quality held by banks.

Related studies measured credit risk as the ratio of non-performing loans to gross loans and the ratio of loan loss provision to gross loans. These measures are appropriate since they can be reliably surrogate as market based risk measurements in testing the influence of credit risk to stock returns (Der-Fen, 2005; Abu, Sajeda & Mustafa, 2015).

Non-performing loans (NPLs) refers to the state of loan obligations falling short of contractual provisions in a way that is detrimental to capital and earnings of a financial institution. Central Bank of Kenya classifies outstanding debt obligations according to the number of days the debt has fallen due. Normal classification describes debt obligations due for payment within 30 days; Watch classification are debt obligations due for payment past 30 days but less than 90 days; Sub-standard classification are loans due past 90 days but less than 180 days; Doubtful NPLs are loans due for settlement past 180 days but less than 360 days; Loss classification are NPLs due for settlement past one year (CBK Prudential guidelines, 2013).
Research findings established that deficient credit risk management techniques, insider lending and manager insatiable appetite for lending are the main contributors of high NPLs in banks. The impact of excessive credit risk on commercial banks can be well described by the effects of global financial meltdown on banks (Milleris, 2012). Poor credit policies and procedures contribute to poor bank asset quality, agency conflict and increased litigations between the bank and the customer. Due to high appetite for profits by banks, bank managers need to establish an optimal amount of interest income due on loans to tame the cyclical effects of systemic credit risk. (Kang & Kang 2009). Profitable banks have employed elaborate credit management strategies to optimize the benefits of lending and minimize the adverse effects of credit risk. Prudent banks lay clear credit risk structures, allocate responsibilities, outline disciplined credit process, enhance efficient communication and promote accountability.

Loan loss provisioning is the policy where banks recognize and provide in their books an estimated proportion of reserves for loss of a loan portfolio before the actual default materialize. It is a direct charge from bank earnings used to protect bank capital when the loss on default crystalizes (Beatty and Liao, 2009). Central bank prudential guidelines require banks to provide for general provisions at 1% of total loan portfolio with specific provision pegged on outstanding loans classified as non-performing loans beyond normal classification. Specific provisions on non-performing loans classified under watch classification are provided at 3% of outstanding non-performing loans between 30 to 90 days, sub-standard classification loss provision is provided at 20% of outstanding non-performing loans between 90 to 180 days, doubtful and loss classification are provided at 100% of total loans and interest overdue beyond 180 days. The increasing level of loan loss reserves may indicate a doubtful quality of bank assets. Similarly, increasing level could also denote eminent economic downtime or more appetite by the management to venture into risky lending. Investors interested in bank stockmonitor the trends on bank loss provisions to make buy, sell or hold investment decisions (Dugan, 2009). Aggregate credit risk index in Kenya has been on the increase indicating that commercial banks are sitting over an impending tragedy on revenue streams due to overreliance on interest income from loans. The banking industry in Kenya has experienced an increase in general and special provision due to high NPLs. This trend is likely to affect dividends to shareholders as a result of reduced earnings. The regulation on interest capping to Kenyan banks provoked banks in tightening credit standards resulting to contracted supply for credit in the third quarter 2016. Overall non-performing loans increased in 8 economic sectors and reduced in 4 economic sectors (CBK Credit Officer Survey, 2016).

The enactment of law on interest rate capping in Kenya led investors in the stock market to lose $2.4 billion on banks stock as the news on regulation hit the Nairobi Securities Exchange (NSE, 2016). The news on the interest capping resulted to mixed misfortune to investors at Nairobi Securities Exchange. Traditionally banking stocks in Kenya have been on high demand in the past due to high dividends and remarkable performance of the Kenyan financial sector. However, the law on interest rate capping and emerging effects of global financial risk on bank stocks is reversing the trend resulting to drop in bank stock prices (CBK, 2015).

1.1 Statement of the problem

The banking industry in Kenya has been experiencing increasing non-performance in asset quality resulting to three banks being place under receivership and one bank under liquidation during the year 2015. Stocks in the banking sector dipped due to systemic effects arising from increased credit risks and associated financial risks. The Kenya government and Central Bank of Kenya in September, 2016 enacted a law to cap interest rate on loans at 4% above the Central Bank Rate in a bid to reduce the cost of borrowing. Implementation of the new law remains a puzzle as banks claim that law does not accommodate the risk of default. Since enactment of the law on interest capping the volume of credit has reduced slowing economy growth and constraining liquidity in the stock market (CBK Credit Officer Survey, 2016).

Empirical studies on the influence of credit risk on stock returns of commercial banks and the effect of bank size on relationship between credit risk and stock returns are yet to provide a substantial causal link. Findings still exhibit a series of mixed reactions. Reasonable conclusion from few empirical literature establish that credit risk influences stock returns (Naser et al., 2011; Li & Sandeep, 2007; Mehri, 2015; Kang & Kang, 2009; Muhammad, et al., 2015; Nurazi & Evans, 2005). Lack of studies on the influence of credit risks on stock returns in Kenya and mixed reactions and inconclusive findings from the previous empirical studies forms the motivation of this study. The findings of this study provide more clarity on influence of credit risk on stock returns in Kenya and the moderating effect of bank size on the influence of credit risk on stock returns. The findings of the study will be helpful to investors, risk managers, speculators and the government. The study answers the question of whether there exists an influence of credit risk on stock returns in the Kenya.

II. LITERATURE REVIEW

2.1 Modern Portfolio Theory

Modern Portfolio Theory (MPT) is a finance theory developed in 1950 by Nobel Prize winner Harry Markowitz. According to MPT theory, an optimal investment decision is one that maximizes the expected return for a given level of risk, or an investment decision that minimizes risk for a given expected return over a specified portfolio. MPT described an investment principle of diversification where a collection of individual risky assets yields a portfolio with overall discounted risk over a specified expected return (Markowitz, 1952).

Markowitz (1952) indicated that returns of stocks and bonds move in opposite directions, but a combination of both yields a portfolio with overall lower risk for a given return. He also observed that a portfolio constituted by positively correlated assets result to lower risk. Kang and Kang (2009) conducted a study on the impact of individual firm credit spread and stock returns. They argued
that the theoretical puzzle of the higher risk the higher the returns holds only for stable financial periods. The notion of negative effect of on returns due to increased risk applies to periods of financial distress. Banks manager’s builds loan portfolio based on different sectors of the economy which constitute an uncorrelated credit risk loan portfolio. This combined diversified risk based on varied sectors yields an overall impact of reduced credit risk due to a loan portfolio. This analogy proves that the MPT theory remains relevant in sustainability and significance of banking to investors and the economy with regards to lending business.

2.2 Agency Theory
This refers to the relationship that exists between firm owner and individuals given authority by the owners of the firm to direct and control the capital and earnings to the owner’s benefits and interest. It describes the link between the shareholders and the managers of an entity assuming managers possess professional skills and the do not own shares of the entity (Jensen & Meckling, 1976). Agency conflict is a major contributor of increased credit risk in banking industry. The relationship between credit risk and agency conflict contributed to global financial crisis and the collapse of the investment firms such as Bear Stearns and Lehman brothers. Agency problem can be controlled by large institutions through internal mechanism within firms and market discipline amongst industry players (Donnellan & Rutledge (2016). Bank managers need to control risk on behalf of shareholders. Credit risk forms the most crucial risk in financial institutions and if monitored through internal and external checks it will influence the shareholder value positively.

2.3 Loanable funds Theory
Loanable fund theory explains the premium charged and the real cost of borrowing. It contends that the cost of credit is determined by the equilibrium of demand and supply of loanable funds. The theory categorizes consumers of credit to be government, consumers, domestic and foreign business while supplies of credit as saving units and banks. It describes determination long term interest under perfect market leaving short term interest rate to be determined by central banks monetary policy (Mc Gibany & Nourzad, 2007). In Kenya, the law on capping of the interest rates on borrowed funds sparked controversy whether cost of loanable fund should be a factor of market forces or government regulation. According to Central Bank of Kenya, the aftermath of interest capping indicated a decline in supply of loanable funds from banks with claim that the capped interest rates does not factor the premium on default risk. This constrained the flow of liquidity in the economy. This stands as a recipe to trigger re-emergence of related financial risk such as liquidity, capitaland market risks (CBK Credit Officer Survey, 2016).

2.4 Conceptual Framework
The conceptual framework describes credit risk as the main independent variable supported by the ratio of non-performing loans and loan loss provision as sub variables. Bank size is the moderator variable in the model while the stock return is the dependent variable.

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<tr>
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<th>Dependent Variable</th>
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<tr>
<td>• Non-performing loans/Gross Loans</td>
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<td>• Loan Loss Provisions/Gross Loans</td>
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<td>Bank Size</td>
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<td>• Log of Asset Base</td>
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<td>Stock Returns</td>
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Figure 2.1: Conceptual Framework

2.4.1 Non Performing Loans
Non-performing loans (NPLs) refers to the state of loan obligations falling short of contractual provisions in a way that is detrimental to capital and earnings of a financial institution. In line with empirical studies on credit risk, this study measured credit risk as the ratio of non-performing loans to gross loans (Der-Fen, 2005; Kolapo, Ayeni & Oke, 2012; Abu, Sajeda & Mustafa, 2015; Michael, William & Gary, 2001).

2.4.2 Loan Loss Provisions
Loan loss provision refers to capital, earnings or reserves set aside to safeguard the bank from eventual loss in the event of loan defaults (Floro, 2010). Loan provisions are classified into general and specific provision. General provisioning entails the act of determining the likely amount of loss an aggregate loan portfolio may incur. Specific provisions entail setting aside a proportion of funds from already classified loan portfolio. The ratio of loan loss provisions to gross loans has been used measure credit risk in this
study imitating various empirical studies (Der-Fen, 2005; Kolapo, Ayeni & Oke, 2012; Abu, Sajeda & Mustafa, 2015; Michael, William & Gary, 2001; Floro, 2010).

2.4.3 Bank Size.

Similar to most studies on financial risk and stock returns, this study employed banks size as a moderator variable measured by the log of asset base. Empirical literature denotes that large banks can diversify their asset portfolio resulting to an overall discounted risk exposure compared to smaller banks. The effect of bank size on the influence of credit risk on returns remains a puzzle as evidenced during the 1997-1998 global financial crisis where large banks were negatively affected by the turmoil compared to small banks. Based on these varied developments in the global financial sector, this study pursued to test the effect of bank size on the influence of credit risk on stock returns for listed banks in Kenya (Sobia et al., 2015; Floro, 2010; Shariat & Khosvari, 2008).

2.4.4 Bank Stock Returns

Stock return is the change in capital or wealth due to an investment. The changes could occur due to cash flows such as earnings, dividends or interest or due to negative or positive changes in prices (Mehri, 2015). To determine stock returns the study used following formula applied by Purnamasari et al. (2012) and Predescu and Stancu (2011) in calculating the stock returns:

**Equation 2.1: Equation Formula on Determination of Stock Returns**

\[
R_{it} = \ln\left(\frac{P_t + Div}{P_{t-1}}\right)
\]

Where, \(R_{it}\) denote the continuously compounded individual bank stock returns at time t. \(P_t\) is the Stock price at the end of the period, \(P_{t-1}\) is the stock price at the end of the previous period and \(Div\) is the cash dividend received during the period. In this study stock return was computed annually from 2006 to 2015. Logarithmic returns are preferable because they are tractable when handling many sub periods for a long horizon. They are also statistical and conform to normal distribution (Mouna & Anis, 2015).

2.5 Empirical Review

Naser et al. (2011) conducted an empirical study to establish the effect of credit and exchange risk on stock returns conditional volatility of banks in Australia using asymmetrical and symmetrical GARCH models. The result of the research found out that there exist meaningful association between credit risk and market risk with stock return volatility. The findings of the study also established that financial risk helps to predict a stock return which is helpful to investors and regulators. Felix and Claudine (2008) carried out a study on the relationship between bank performance and credit risk management. They measured credit risk using the ratio of non-performing loans to gross loans. Their study established that the ratio non-performing loan is inversely related to profitability.

Hatfield and Lancaster (2000) examined an empirical paper to find out the stock market response to announcements of loan loss reserve. They investigated a sample of 121 banks relating to loan loss provision announcements between 1983 and 1992. Their study established that abnormal stock returns was significantly negative before the event date, but significantly positive after the event but noted that the stock market behavior to loan provisions also depended on loan category and loan period.

Li and Sandeep (2007) conducted an empirical study on loan loss provisions by banks in Hong Kong and Singapore. The study established that unexpected loan loss provisions are positively related with bank stock returns and future cash flows. The study found that and managers use excess profits to build up capital provisions to build appetite of higher credit risk. This signals positive bank performance to investors and possibility of increased interest income on loans due to increased appetite for lending. The relationship between loss provisions and bank returns were found stable and positive outside Asian financial crisis period. This study supported the findings of Kanagaretnam, Lobo, and Mathieu (2004) on earnings management variability an evidence of loan loss provisions.

Domikowsky, Duellman, Bronnemann and Pfingsten (2014) examined the pro-cyclicality of loan loss provisioning based on expected loss in Germany. The study established that banks adopt forward looking provisioning mechanism to enable them undertake credit risk in anticipation of higher non-performing loans. Loan loss provisioning was also found to help banks in tax shielding. Proactive loan loss provisions due to cyclical economic tendencies lead to stable incomes during depressed economic times.

Kithinji (2010) conducted a study on credit risk management on profitability of commercial banks in Kenya. The study covered the period 2004 to 2008 focusing on the amount of credit, level of non-performing loans and profitability. The study found that profitability of commercial banks is not influenced by the amount of gross loans and non-performing loans. The study findings implied that there could other factors that impact on bank profitability. Steiger (2010) examined the influence of stock options and credit risk on stock returns. The study used tradable credit derivatives of credit default swaps and interest rates to measure credit risk. The study established high explanatory power between credit default swaps and stock returns.

Kargi (2011) investigated the effects of credit risk on profitability of Nigerian banks for the period 2004-2008 which was analyzed using regression techniques. The study concluded that increase in loans and advances, deposits and non-performing loans
exposes banks to distress and illiquidity risk. The ratio of loans to advance and non-performing loans inversely influenced banks profitability. These findings inferred that credit risk management has a significant influence on profitability of Nigerian banks.

Khalid (2012) examined the impact of asset quality on Profitability of Private Banks in India over the period 2006-2011. The study established that asset quality and operating performance are positively correlated. Aghababaei et al. (2013) investigated the effects of credit risk indicators on shareholders’ value of commercial banks listed in Tehran Stock Exchange- Iran. The study covered 6 years from 2005 to 2010 and concluded that credit risk indicators have a significance influence on shareholder value. Da Silva (2014) conducted an empirical investigation on the impact of sovereign credit risk measured by credit default swaps on the stock market measured by the stock prices. The objective of the study was to establish the correlation of credit default swap spread and stock prices. Although granger causality assessment indicated a close link between stock markets and severing credit risk; the study conclusion found out that deterioration of sovereign debt quality or increase in credit default swaps does not indicate sensitivity of the stock prices. Findings also indicated that the lead and lag relationship between sovereign debt and stock market are pronounced during stable periods.

Jansen (2012) examined the impact of credit risk on stock returns at the German, French and Dutch stock markets for the period 2004-2012. The objective of the study was to ascertain whether systematic risk embedded on the credit spread affects stock returns. The study found out that there is no significant relationship between excess returns on stocks and credit spreads.

Kang and Kang (2009) conducted a study on the impact of individual firm credit spread and stock returns. They argued that higher risk lead to reduced returns occurs only during periods of financial distress. Otherwise, the Modern Portfolio Theory of the higher risk the higher returns hold for stable financial periods. The study emphasized that the fundamentals of risk and returns tradeoff must apply under perfect market conditions where investors undertaking any incremental risk must compensate with a risk premium.

Lucky and Nwosi (2015) investigated the relationship between asset quality and profitability of quoted commercial banks in Nigeria for the period 1980-2013. The study variables of asset quality and profitability was represented by the CAMELS criteria: Non-performing loans to total loans, non-performing loans to total customer deposit, loan loss provision to total loans and loan loss provisions to total assets. The study established that non-performing loans to total loans and non-performing loans to customer total deposit had a positive relationship with return on investments. Loan loss provision to total loans and loan loss provisions to total assets had an inverse relationship with return on investments. The study concluded the existence of a significant relationship between the asset quality and profitability of commercial banks.

Million, Matewos and Sujata (2015) investigated the impact of credit risk on profitability of commercial banks in Ethiopia for 12 year period (2003-2004). The study concluded that credit risk indicators: Loan Loss provisions, non-performing loans and capital adequacy have a significant impact on profitability of commercial banks in Ethiopia. Abu et al. (2015) undertook an empirical study to establish how credit risk affects bank profitability in Bangladesh for the period 2003 to 2013. Credit risk was measured using the ratio of Non-Performing Loans to Gross Loans (NPLGL), ratio of loan loss reserve to gross loans (LLRGL), ratio of Loan Loss Reserve to Non-Performing Loans (LLRNPL) and Capital Adequacy Ratio (CAR). Profitability indicators used included return on asset (ROA) and Return on Equity (ROE). Their findings established a negative significant effect of NPLGL and LLRGL on all profitability parameters and a significant negative effect of CAR on ROE concluding that credit risk affects banking profitability in Bangladesh.

Muhammad, Masdar, Abdul and Zakaria (2015) conducted a study to establish the effect of bank ownership, non-performing loans and loan to deposit ratio. The study determined that given that bank ownership was not significant to bank profitability, risk measures of loan to deposit ratio and non-performing loans directly influenced return on equity and stock price index. Nurazi & Evans (2005) conducted a study to establish the impact of CAMEL ratios on bank stock returns. The study established that Capital Adequacy Ratio positively affect bank stock returns, while the Non-Performing Loans ratio and Loans to Deposit Ratio depict negative association with bank return in Indonesian banking sector.

### III. METHODOLOGY

The study employed correlational research design to describe the relationships that exist between variables. Target population comprised of all 43 commercial banks licensed by the Central Bank of Kenya as at 31st December 2015 with an accessible population of 11 commercial banks licensed by CBK and listed at Nairobi Securities Exchange. The study assumed purposive sampling technique to come up with a sample that best represent the population (Lavrakas (2008). The sample comprised of 9 commercial banks listed in Nairobi Securities Exchange between years 2006 to 2015. They included Barclay, CFC Stanbic, Diamond Trust, Equity, Housing Finance, Kenya Commercial Bank, National Bank of Kenya, National Industrial Credit Bank (NIC) and Standard Chartered. The study dropped the effects of corporate events such as mergers and acquisitions and rights issues around the announcement dates with an event window of ±10 days. This is because corporate events contain temporary effects on stock returns which are not related to financial risk (Shah and Arora, 2014). The study employed annual secondary data for ten years for the period 2006 to 2015. Data from Nairobi securities exchange was used to calculate the stock returns for the listed banks while banking survey manual and financial institution reports were be used to give credit risk indicative ratios. Econometric techniques were used to describe the influence of credit risk on stock returns of commercial banks listed in Kenya. The data was first be subjected to diagnostic test of normality using Jarque-Bera test, Breusch-Godfrey test was used to test autocorrelation between the errors where acceptance of the null hypothesis for zero autocorrelation was deemed appropriate. Stationary test of the time series data was examined through Augmented Dickey Fuller test. R statistical software was applied for regression analysis. T-test was used to administer for significance of the ratio of non-
performing loans and loan loss provision on stock returns of commercial banks listed in Kenya. The combined significance of sub
variables of credit risk was used to determine the overall influence of credit risk on stock returns. The model is as described below

\[ R_{it} = \alpha_0 - \beta_1 NPG_{it} + \beta_2 LLG_{it} + \beta_3 BSIZE_{it} + \beta_4 (NPG \times BSIZE) - \beta_5 (LLG \times BSIZE) + \epsilon_{it} \]

Where:
- \( R_{it} \) = Stock Returns
- NPG = Ratio of Non-Performing Loans to Gross Loans
- LLG = Ratio of Loan Loss Provisions to Gross Loans
- BSIZE = Bank Size denoted as log of asset base
- NPG*BSIZE = Interaction term between ratio of non-performing loans and bank size denoting moderating effect of the moderator variable
- LLG*BSIZE = Interaction term between ratio of loan loss provisions and bank size denoting moderating effect of the moderator variable
- \( \epsilon \) = Error term and \( \alpha \) = constant
- \( \beta \) = coefficient of independent variables

### IV. DATA ANALYSIS AND DISCUSSIONS

#### 4.1 Descriptive Results

Table 4.1 provide the summary of descriptive statistics of the sample showing mean, standard deviation, minimum, maximum, skewness, kurtosis and Jarque-Bera of the independent variables, moderator variable and the dependent variable. The results show that a 10 years investment in the banking stocks obtained an average stock return of 6.34% with a deviation of 3.52%. The portfolio at risk averaged 6.4% in ten years slightly below the industry benchmark of 7% with a deviation of 3%. Banks cushioned themselves against implications of credit risk during the year 2006 to 2015 by increasing the ratio of loan loss provision to gross loans (LLG) by 5.39% with an average bank size of ksh 14.3 billion (ZS).

<table>
<thead>
<tr>
<th>Descriptives</th>
<th>Rt</th>
<th>npg</th>
<th>lg</th>
<th>zs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.0634</td>
<td>0.0640</td>
<td>0.0540</td>
<td>14.3824</td>
</tr>
<tr>
<td>Median</td>
<td>0.1572</td>
<td>0.0600</td>
<td>0.0378</td>
<td>14.4512</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.4929</td>
<td>0.1410</td>
<td>0.1669</td>
<td>15.1060</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.5957</td>
<td>0.0367</td>
<td>0.0293</td>
<td>13.4810</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>0.3520</td>
<td>0.0307</td>
<td>0.0420</td>
<td>0.5359</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.6147</td>
<td>1.6298</td>
<td>2.1846</td>
<td>-0.2838</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.2231</td>
<td>5.0699</td>
<td>6.5096</td>
<td>1.9374</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>0.8812</td>
<td>6.2125</td>
<td>13.0867</td>
<td>0.6047</td>
</tr>
<tr>
<td>Probability</td>
<td>0.6436</td>
<td>0.0448</td>
<td>0.0014</td>
<td>0.7391</td>
</tr>
<tr>
<td>Observations</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

#### 4.2 Diagnostic Test

Normality Test was examined using Jarque Bera test. The test obtained a p-value of above 5% level of significance of 0.643643 and 0.739093 for stock return and bank size respectively, indicating normal distribution of the variables. The ratio of non-performing loans and the ratio of loan loss provision held p-values below 5% level of significance of 0.044768 and 0.00144 respectively indicating non-normal distribution of the variable. The study addresses non-normality by the use generalized least square model (GLS). The results of the test are shown in table 4.1. To test for stationarity, the study used Augmented Dickey Fuller test. Results in table 4.2 shows stock returns and the ratio of loan loss provision had ADF t-statistic greater than ADF critical value indicating existence of unit root. We therefore accept null hypothesis that the variables are non-stationary. The ratio of non-performing loans show ADT t-statistic lower than ADF critical value which implied unit root does not exist and therefore we reject null hypothesis and conclude the variable is stationary at order at order 1. Stationarity was determined at a point where t-statistic was lower than the critical value at 5% significance level.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test at Levels</th>
<th>ADF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Autocorrelation test was done using Breusch Godfrey test. The test was ideal for running autocorrelation test since it accommodates lag of residuals at higher orders compared to Durbin Watson which incorporates lag of residuals only at order 1. Table 4.3 show result of the test with a p-value of 0.2086 which is higher than 0.05 level of significance signifying that we accept the null hypothesis that autocorrelation does not exist.

### Table 4.3 Breusch-Godfrey Test

<table>
<thead>
<tr>
<th>Statistic</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5808</td>
<td>0.2086</td>
</tr>
</tbody>
</table>

Pearson correlation test was done to confirm the degree of multi-collinearity between the variables. Table 4.4 revealed returns to be positively correlated to non-performing loan (npg) and the level of loan loss provision (llg) while bank size (bsize) was found negatively correlated to stock returns. The variables exhibited correlations coefficients of 0.099, 0.185 and -0.090 for npg, llg and bsize on stock returns (Rt) respectively. The test results implied absence of multi-collinearity among selected variables.

### Table 4.4 Correlations Matrix

<table>
<thead>
<tr>
<th>Correlations Parameter</th>
<th>Rt</th>
<th>npg</th>
<th>llg</th>
<th>bsize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rt</td>
<td>Pearson Correlation</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>npg</td>
<td>Pearson Correlation</td>
<td>0.099</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>llg</td>
<td>Pearson Correlation</td>
<td>0.185</td>
<td>0.957</td>
<td>1.000</td>
</tr>
<tr>
<td>bsize</td>
<td>Pearson Correlation</td>
<td>-0.090</td>
<td>-0.717</td>
<td>-0.793</td>
</tr>
<tr>
<td>Observations</td>
<td></td>
<td>10.000</td>
<td>10.000</td>
<td>10.000</td>
</tr>
</tbody>
</table>

Lastly, we examined the errors terms for constant variance using Breusch-Pagan test at 5% level of significance. Test results shown in table 4.5 below indicate there was no enough evidence to reject the null hypothesis for presence of constant variance. The test results therefore implied that there was uniform variance in the error terms which is appropriate for the model.

### Table 4.5 Breusch-Pagan Test

<table>
<thead>
<tr>
<th>Statistic</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4341</td>
<td>0.4887</td>
</tr>
</tbody>
</table>

### 4.3 Regression analysis, hypothesis testing and Discussions

The hypothesis testing result on the influence of credit risk on stock returns of commercial banks listed at Nairobi Securities Exchange is outlined in table 4.6. The regression was based on generalized least squares fit by maximum likelihood with a correlation structure of ARMA (3, 0) using R software. The model was found significant on all the variables net of the constant. Non-performing loans, loan loss provision and bank size significantly influenced stock returns at a p-value of 0.0136, 0.0279 and 0.0351 respectively at 5% level of significance. The moderator variable of bank size was also found to significant to affect the influence of non-performing loan and loans loss provision on stock returns with a p-value of 0.0149 and 0.0285 respectively.

### Regression Model

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Coefficient Value</th>
<th>Standard Error(S.E)</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>npg</td>
<td>-879.467</td>
<td>236.1141</td>
<td>-3.7248</td>
<td>0.0136</td>
</tr>
<tr>
<td>llg</td>
<td>2781.6773</td>
<td>907.0454</td>
<td>3.06675</td>
<td>0.0279</td>
</tr>
</tbody>
</table>
4.3.1 The influence of non-performing loans ratio on stock returns

Hypothesis testing results indicated that the ratio of non-performing loans to gross loans negatively and significantly affect stock returns. The results met the expectation of the study and conform to the basics of Modern Portfolio Theory that excessive risk eventually decreases returns on investments. The results were related to Nurazi & Evans (2005), Muhammad, et al (2015), Naser et al. (2011) and Kang & Kang (2009). However, the direction of influence was contrary to the study of Li and Zou (2014) which found credit risk positively related to stock returns while Janssen (2012) found credit risk to be insignificant to stock returns.

4.3.2 The influence of loan loss provisions ratio on stock returns

Regression result on the influence loan loss provision on stock returns confirmed a positive significant relationship. This result related to the findings of Li and Sandeep (2007), Hatfield and Lancaster (2000), Kanagaratnam, et al (2004) and Domikowsky, et al. (2014). The findings were contrary to observations of Hatfield and Lancaster (2000) who asserted that abnormal stock returns was significantly negative before the event date.

4.3.3 The moderating effect of bank size on the influence of credit risk on stock returns

Hypothesis testing result on effect of bank size as a control and moderator variable on stock returns revealed a positive and significant relationship. The regression result indicated that bank size bears a significant effect in influencing the effect of credit risk on stock returns. The findings were related to the study of Fafri et al. (2009), El Mehdi (2014). However, the finding contradicted with findings of Aga, et al. (2013) who observed that company size is primary cause of variability on shareholder value.

4.3.4 Influence of credit risk on stock returns

To determine the influence of credit risk on stock returns, the study through GLS model regressed predictor variables: non-performing loans (npg), loan loss provisions (llg) and bank size (bsize) on stock returns (Rit). The study results on table 4.6 indicated all variable were significant on stock returns leading to an overall conclusion of study that credit risk significantly influences stock returns. Coefficients of non-performing loan and moderating factor of bank size and loan provision in the model carried a negative sign while coefficient value of loan loss provisions indicated a positive effect on stock returns. The model coefficient signifies the rate of change of the dependent variable for every 1 unit change on the explanatory variable ceteris paribus. Stock returns (R _it) decreases by -879.467 (-) for every increase in 1 unit non-performing loans ratio. Comparable illustrations can be deduced with other coefficient values. The resultant model can hence be stated as:

$$R_{it} = -1 - 879.47 \text{NPG}_{it} + 2781.67 \text{LLG}_{it} + 0.37\text{BSIZE}_{it} + 66.22 (\text{NPG}*\text{BSIZE}) – 209.58 (\text{LLG}*\text{BSIZE})$$

V. CONCLUSION

The study concluded that the ratio of non-performing loans to gross loans holds a negative significant effect on stock returns. The results indicated that investors consider non-performing loans a critical source of information in their investment decisions. Banks with high levels non-performing loans are occasioned with reduced profits which affects dividend and demand for stocks at the stock market. Market discipline and disclosure on the state of credit risk in banks enable investors to prospect on buy, sell or hold investment decisions depending with their investment strategies.

The ratio of loan loss reserve to gross loans was concluded to positively influence stock returns. This signifies that banks with high returns provide for more loan loss provisions to enhance a greater appetite for credit risk in future. This is usually a strategy employed by large banks to gain advantage on tax shields. The result shows that investors in the stock market consider high provisions as a safeguard for their investments. High loan reserves act as a cushion for banks venturing into risky lending which translate to high profitability and consequently increased capital gains and dividends.

The study concluded that bank size is a critical factor used by investors when considering the affects credit risk on stock returns. Overall result shows that big banks categorized by the size of assets are able to accommodate a higher risk appetite which comes with higher returns. Investors at Nairobi securities Exchange prefer placing their fortune in large banks because they are resilient to credit risk and other related financial risk. Investment in large banks is found favorable since they diversify their portfolio and therefore reduce their overall risk on investment.

The study concluded that credit risk influences stock returns of commercial banks listed in Kenya. The findings conformed to empirical evidence according to Janssen (2012); Naser et al. (2011) and Domikowsky, et al. (2014). Investors in banking stocks in Kenya consider credit risk a valuable factor in making decision to maximize their investments.
1.1 Recommendations

The following recommendations and policy implications can be deduced. The study shows that the ratio of non-performing loans have a significant effect on stock returns. In light of this conclusion, bank top management should profile the risk of borrowers and define the optimal level of lending appetite. Central bank of Kenya should undertake to regulate and inspect top loans advanced by banks and established the scope of insider lending. Similarly, Capital market authority should enhance transparency and disclosure policy to safeguard investors with regards to portfolio at risk, ratio of loans to deposit and disclosure on insider lending. Investors need to monitor if the the levels of non performing loans against reductions in stock returns. Investors should also monitor signals of increasing credit risk to make prompt decision on either sell, buy or hold. On policy implication, central bank of kenya through risk and prudential guidelines could adjust the recommended benchmark threshold ratio of loan to deposit, loan size distribution and the ratio of non-performing loans to gross loans.

On second objective, the study concluded that loan loss provisions influences on stock returns. The study recommends, bank managemenent to provide adequate provisions to take care of bad loans without affecting the going concern of the bank. Adequate provisions encourage banks to advance credit to untapped risky segments. Central bank of Kenya need provide an oversight role to ensure banks are complying with regulated standards of general and specific provisons, this will enhance investor confidence and increase returns on investments. The study will benefit investors on buy or sell decisions, speculation or hedging options on bank stocks. Based on the findings, Central Bank of Kenya could make adjustment on credit risk capital to cater for counter party risk.

The objective on moderating effect of bank size on the influence of credit risk on stock returns, established that size is a factor of risk. Big banks are tolerant to risk and therefore for large banks, manager should avoid over diversification. Central banks of Kenya to safeguarded critical big banks in the economy through constant monitoring. Policy makers through an act of parliament to consider increasing absolute amount of core capital held by bank to safeguard the economy from adverse impact of too big banks to fall.

5.2 Areas for further research

Due to innovations in global financial enviroment, the measure of credit risk in will keep on changing. In the light of growth of the financial markets in Kenya, the study recommends a further research on influence of credit risk on stock returns measuring the extend of credit risk at derivative market. A study of influence of credit spreads on stock returns can be explored. A comparative study of credit risk on stock returns between Kenya and other other emerging market could be pursued. Due to recent changes in regulatory framework by the government of Kenya on interest rates caping and percolation law on determination of credit risk in banks, an event estudy can be pursued to further this study. As far as the knowledge of the resercher is concerned, this is a pioneer study in Kenya as previous studies have only focused on the effect of credit risk on financial performance. The study focused on holistic approach on influence credit risk on stock returns on listed commercial banks in Kenya.

REFERENCES


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Consumer Food Hygiene and Safety Practices in the Households in Langata Sub-County, Nairobi County, Kenya


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Abstract- Foodborne diseases comprise a broad range of diseases and are responsible for substantial morbidity and mortality worldwide. It is an increasing public health problem in developing as well as developed countries. Increased risks of illness at home may result from unsafe food handling behaviours. Additionally, failure to associate the home as a potential location to acquire foodborne diseases may be a serious barrier for implementation of safe food handling behaviours. The home has become a multifunctional setting comprising of many activities that influences the need for and practice of food safety. In Kenya, there are several studies that have been done in various settings but few documented studies have been done at the household level. This study aimed at evaluating consumer food hygiene and safety practices in the household in Langata Sub-County, Nairobi County, Kenya. The study determined the sociodemographic factors that influence food hygiene and safety practices in the household, established consumer knowledge on safe food handling practices, established consumer attitude on food hygiene and safety practices in the household and established consumer food hygiene and safety practices in the home environment. This study utilized a cross-sectional study design targeting consumers who had the sole responsibility of food preparations in the households. A multistage sampling approach was used. The study was conducted in all the five wards of the sub-county which include; Karen, Soweto Nyayo Highrise, Mugumoini, Langata and Nairobi West. Data was obtained from a total of 385 respondents using interviewer administered questionnaire. Key informant interviews of public health officers, community health assistants and community health volunteers was also used to provide additional information. Data was analysed using SPSS version 20 and presented using tables and pie charts, while association between variables was assessed using Chi-square statistics and Odds Ratio. Findings show that consumer food hygiene and safety practices were at 42.9% in Langata sub-county. Occupation (χ²=39.609, df =4, p=0.000), type of house (χ²=14.986, df=2 p=0.000), main source of water (χ²=8.163, df=3 p=0.041) was statistical significant in relation to food hygiene and safety practices by consumers. 64% of the consumers had good knowledge on food hygiene and safety practices while 79.5% of consumers had positive attitude towards good food hygiene and safety practices. The findings of this study show the need to address food hygiene and safety practices in the households.

Index Terms- Foodborne disease, Consumer, Food Hygiene, Food Safety Practices

I. INTRODUCTION

Food safety is a global health goal and foodborne diseases are a major health problem (Velusamy, Arshak, Korotsynska, Oliwa & Adley, 2010). According to Badrie, Gobin, Dookeran, & Duncan (2006), the most common food handling mistakes include serving contaminated foods, inadequate cooking, heating and re-heating foods, obtaining foods from unsafe sources, cooling and storage of foods in inappropriate ways and allowing too much of a time lapse. Consumer’s behaviors and attitudes towards safe food should be taken into account in order to completely define the term “food safety” and to determine the wrong behaviors and beliefs of the consumers (Bülen, 2013). Although proper food handling, preparation, storage, and feeding practices may prevent many foodborne diseases, each year millions of people become ill and thousands die from these diseases (Kumiko et al., 2009).

World Health Organization estimates 40% of foodborne disease cases originate in the home (Bloomfield & Nath, 2013). Up to 70% of diarrhoea cases in developing countries is said to be caused by pathogens transmitted through food (Kumiko et al., 2009). In Kenya, approximately 88% of diarrhoea associated deaths are attributable to unsafe water, inadequate sanitation and insufficient hygiene (UNICEF, 2006). In the year 2013, Langata reported the highest number of diarrhoea cases managed in the community in Nairobi County, there were 5096 diarrhoea cases managed that year (DHIS, 2014).

The home has become a multifunctional setting and which directly impacts upon the need for better food safety in the home. In particular, the rising population of the elderly, children and other immune compromised individuals living at home who are likely to be more susceptible to the impact of foodborne disease is an essential aspect to consider. Consumer food hygiene and safety practices research is required and relevant to ascertain how food is handled in the domestic kitchen, determine what is known about food safety and why some safe food handling practices are implemented and others are not. In Kenya, few documented studies have been undertaken to assess the roles played by food handlers in the transmission or control of food borne diseases in various setting in particular there is scanty information of food safety in the home environment (Oloo, 2010; Githiri, Okemo & Kiminywe, 2009).
II. MATERIALS AND METHODS

This was a cross-sectional study which was employing both quantitative and qualitative data collection approaches. It considered respondents with sole responsibility of food preparations in the household and aged 18 years and above and had lived in Langata sub-county for at least six months.

Langata sub-county was selected because it had the largest number of diarrhoea cases in Nairobi County as per 2013 District Health Information System. The study was carried out in all the five wards and they included Soweto Nyayo Highrise, Karen, Langata, Nairobi West and Mugumoini. Probability proportionate sampling of households was done. Systematic random sampling was used to select the respondent’s households. In the households, 385 consumers with the responsibility of food preparation were interviewed. Additional qualitative data was obtained through 8 Key informant interviews (KII).

Data checking and cleaning were done simultaneously during data collection. At the end of every field day, data was checked for completeness and consistency. After cleaning, quantitative data was analyzed using the SPSS version 20 for data analysis while association between variables was assessed using Chi-square statistics. Qualitative data was analysed using content analysis based on key themes generated from the objective. A p value of < 0.05 was considered significant.

III. RESULTS

Objective 1: The Level of Consumer Food Hygiene and Safety Practice

A total of 385 consumers were interviewed on food hygiene and safety practices. Thirteen questions were given to the respondent. Overall, one to have prefect practice was to score 52 points. Of these any respondent who scored 27 points and above was treated as having good practice while those who scored 26 points and below were treated as having bad practice. Interviewed respondents’ were categorized into two groups; those who practice and those who did not. Less than half 165 (42.9%) of the participants were categorized practicing good food hygiene and safety. The practice of cooking food thoroughly was scored higher 200 (51.9%) compared to keeping clean 175 (45%), separating raw and cooked food 114 (30%), keeping food in safe temperature 178 (46.2%) and use of safe water and raw material which rated 174 (45.2%) as shown in table 1.

Further statistical analysis showed that in separating raw and cooked food, there was a difference between those who practiced good and bad food hygiene and safety practices ($\chi^2$=64.023, df=1, p=0.000).

<table>
<thead>
<tr>
<th>Food Hygiene and Safety Practice</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Practice</td>
<td>165</td>
<td>42.9</td>
</tr>
<tr>
<td>Bad Practice</td>
<td>220</td>
<td>57.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Keeping Clean</th>
<th>$\chi^2$=3.182, df=1, p=0.074</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Practice</td>
<td>175</td>
</tr>
<tr>
<td>Bad Practice</td>
<td>210</td>
</tr>
</tbody>
</table>

| Total           | 385                             |

<table>
<thead>
<tr>
<th>Separating Raw and Cooked food</th>
<th>$\chi^2$=64.023, df=1, p=0.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Practice</td>
<td>114</td>
</tr>
<tr>
<td>Bad Practice</td>
<td>271</td>
</tr>
</tbody>
</table>

| Total                         | 385                             |

<table>
<thead>
<tr>
<th>Cooked Food Thoroughly</th>
<th>$\chi^2$=0.584, df=1, p=0.445</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Practice</td>
<td>200</td>
</tr>
<tr>
<td>Bad Practice</td>
<td>185</td>
</tr>
</tbody>
</table>

| Total                         | 385                             |

<table>
<thead>
<tr>
<th>Keeping Food in Safe Temperature</th>
<th>$\chi^2$=2.184, df=1, p=0.139</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Practice</td>
<td>178</td>
</tr>
<tr>
<td>Bad Practice</td>
<td>207</td>
</tr>
</tbody>
</table>

| Total                           | 385                             |

<table>
<thead>
<tr>
<th>Use of Safe Water and raw materials</th>
<th>$\chi^2$=3.556, df=1, p=0.059</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Practice</td>
<td>174</td>
</tr>
<tr>
<td>Bad Practice</td>
<td>211</td>
</tr>
</tbody>
</table>

| Total                             | 385                             |

Objective 2: Socio-Demographic Factors that Influence Food Hygiene and Safety Practices in the Household

Socio-demographic characteristics of the respondents are shown in table 2. The results indicate that the mean age of the respondents interviewed was 33.08±9.61, with a median of 35. Out of a total number of 385 respondents who participated, 26 (6.8%) were below 20 years, 151 (39.2%) were aged between 21 to 30 years, 116 (30.1%) were aged 31 to 40 years, 76 (19.7%) were aged between 41 to 50 years and 16 (4.1%) were aged 51 years and above. Majority of the respondents were female 258 (67.0%).

Further results indicated that gender and age does not influence food hygiene and safety practices ($\chi^2$=0.564; df=1; p=0.453) and ($\chi^2$; 6.458 df=4, p=0.167) respectively. However, the number of people in household, main source of water, type of housing were found to influence food hygiene and safety practices. ($\chi^2$ =10.467; df =3; P=0.015), ($\chi^2$ =8.163; df=3; P=0.041 and ($\chi^2$=14.986; df=2; P= 0.000) respectively as shown in table 2.
Table 2: Demographic Characteristics of the Participants (N=385)

<table>
<thead>
<tr>
<th>Socio-Demographic Factors</th>
<th>Hygiene and Safety practices</th>
<th>(\chi^2)</th>
<th>df</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good Practices</td>
<td>Bad Practices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>51 (40.2)</td>
<td>76 (59.8)</td>
<td>0.564</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>114 (44.2)</td>
<td>144 (55.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age categories in years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20 years</td>
<td>11 (42.3)</td>
<td>15 (57.7)</td>
<td>6.458</td>
<td>4</td>
</tr>
<tr>
<td>20-30 years</td>
<td>54 (35.8)</td>
<td>97 (64.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-40 years</td>
<td>53 (45.7)</td>
<td>63 (54.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41-50 years</td>
<td>40 (52.6)</td>
<td>36 (47.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;51 years</td>
<td>7 (43.8)</td>
<td>9 (50.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest education level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None/non formal</td>
<td>1 (11.1)</td>
<td>8 (88.9)</td>
<td>3.939</td>
<td>3</td>
</tr>
<tr>
<td>Primary</td>
<td>53 (42.4)</td>
<td>72 (57.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>86(43.9)</td>
<td>110(56.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>25(45.5)</td>
<td>30 (54.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>50 (39.7)</td>
<td>76 (60.3)</td>
<td>2.964</td>
<td>2</td>
</tr>
<tr>
<td>Married</td>
<td>107 (45.9)</td>
<td>126 (54.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separated or divorced</td>
<td>8 (30.8)</td>
<td>18 (69.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christians</td>
<td>114 (42.2)</td>
<td>193 (57.8)</td>
<td>2.125</td>
<td>3</td>
</tr>
<tr>
<td>Muslim</td>
<td>18 (51.4)</td>
<td>17 (48.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hindu</td>
<td>1 (20.0)</td>
<td>4 (80.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional/Not attached</td>
<td>5 (45.5)</td>
<td>6 (54.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of house</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permanent</td>
<td>70 (48.6)</td>
<td>74 (51.4)</td>
<td>14.986</td>
<td>2</td>
</tr>
<tr>
<td>Semi-Permanent</td>
<td>69 (48.6)</td>
<td>73 (51.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary</td>
<td>26 (26.3)</td>
<td>73 (73.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of people in HH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;two</td>
<td>37 (38.9)</td>
<td>58 (61.1)</td>
<td>10.467</td>
<td>3</td>
</tr>
<tr>
<td>Three- four</td>
<td>51(35.2)</td>
<td>94 (64.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Five- six</td>
<td>61 (54.0)</td>
<td>52 (46.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;seven</td>
<td>16 (50.0)</td>
<td>16 (50.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main source of water by HH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piped water in house</td>
<td>90 (49.7)</td>
<td>91 (50.3)</td>
<td>8.163</td>
<td>3</td>
</tr>
<tr>
<td>Piped water in public stand</td>
<td>60 (38.5)</td>
<td>96(61.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From water vendors</td>
<td>11 (28.2)</td>
<td>28 (71.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borehole</td>
<td>4 (44.4)</td>
<td>5 (55.6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Objective 3: Consumers’ Knowledge on Food Hygiene and Safety Practices

The third objective of this study was to assess the consumer knowledge on food hygiene and safety. Knowledge of the participants in regards to food hygiene and safety was measured using a dichotomous scale. Fourteen knowledge questions were asked to participants and answers were graded by giving a point for the right answer and 0 point for the wrong answers.

Overall results indicate that 63.9% (246) of the respondents had adequate knowledge while 36.1% (139) had inadequate knowledge as shown in figure 1. Further analysis showed that the overall consumer knowledge was not a factor influencing food hygiene and safety ($\chi^2 = 0.586; df=1; P<0.444$). However, there were knowledge statements on food hygiene and safety that were found to influence food hygiene and safety as shown in table 3.

![Figure 1: Consumer Knowledge on Food Hygiene and Safety](image)

Results indicated that 97.9% (n=377), 73.8% (n=284) and 33.2% (n=128) were aware that handwashing with soap and running water before handling food is crucial, wiping clothes spread microorganisms and hands should not be wiped with reusable towels respectively as shown in table 3.
Table 3: Consumers’ Knowledge in Food hygiene and Safety Practices (n=385)

<table>
<thead>
<tr>
<th>Knowledge Statements</th>
<th>Correct Answer</th>
<th>Incorrect Answer</th>
<th>Chi square</th>
</tr>
</thead>
<tbody>
<tr>
<td>One should wash hands with running water and soap before handling food.</td>
<td>377 (97.9%)</td>
<td>8 (2.1%)</td>
<td>$\chi^2=3.074, df=1, p=0.080$</td>
</tr>
<tr>
<td>Hands should be dried with a reusable towel.</td>
<td>128 (33.2%)</td>
<td>257 (66.8%)</td>
<td>$\chi^2=0.165, df=1, p=0.685$</td>
</tr>
<tr>
<td>Wiping clothes like hand towels can spread microorganisms.</td>
<td>284 (73.8%)</td>
<td>101 (26.2%)</td>
<td>$\chi^2=0.091, df=1, p=0.069$</td>
</tr>
<tr>
<td>The same cutting board can be used for raw and cooked foods provided its clean</td>
<td>163(42.3%)</td>
<td>222 (57.7%)</td>
<td>$\chi^2=9.962, df=1, p=0.002$</td>
</tr>
<tr>
<td>Raw food needs to be stored separately from cooked food</td>
<td>339 (88.1%)</td>
<td>46(11.9%)</td>
<td>$\chi^2=1.391, df=1, p=0.238$</td>
</tr>
<tr>
<td>Cooked leftover do not need reheating thoroughly before eating</td>
<td>264 (68.6%)</td>
<td>121 (31.4%)</td>
<td>$\chi^2=3.861, df=1, p=0.049$</td>
</tr>
<tr>
<td>Cooked food should be kept very hot before serving</td>
<td>306 (79.5%)</td>
<td>79 (20.5%)</td>
<td>$\chi^2=3.058, df=1, p=0.080$</td>
</tr>
<tr>
<td>Meat should be cooked until juice are clear</td>
<td>352 (91.4%)</td>
<td>33 (8.6%)</td>
<td>$\chi^2=8.974, df=1, p=0.003$</td>
</tr>
<tr>
<td>Safe water can be identified by the way it looks</td>
<td>217(56.4%)</td>
<td>168(43.6%)</td>
<td>$\chi^2=17.249, df=1, p=0.000$</td>
</tr>
<tr>
<td>Storing food in containers with lids prevents contamination</td>
<td>290 (75.3%)</td>
<td>95(24.7%)</td>
<td>$\chi^2=7.268, df=1, p=0.007$</td>
</tr>
<tr>
<td>Meat products should be stored separate from other cooked food minimize cross-contamination</td>
<td>319 (82.9%)</td>
<td>66(17.1%)</td>
<td>$\chi^2=0.123, df=1, p=0.725$</td>
</tr>
<tr>
<td>Cooked food can stored at room temperature for more the two hours</td>
<td>154 (40%)</td>
<td>231(60%)</td>
<td>$\chi^2=2.828, df=1, p=0.093$</td>
</tr>
<tr>
<td>Washing vegetables and fruits before eating makes them safe</td>
<td>367 (95.3%)</td>
<td>18 (4.7%)</td>
<td>$\chi^2=8.837, df=1, p=0.003$</td>
</tr>
<tr>
<td>For as long as food taste, smells and looks okay it is safe to eat</td>
<td>188(48.8%)</td>
<td>197 (51.2%)</td>
<td>$\chi^2=0.684, df=1, p=0.408$</td>
</tr>
</tbody>
</table>
Objective 4: Consumer Attitude on Food Hygiene and Safety Practices

Attitude of the respondents on food hygiene and safety practices was measured using Likert scale (Likert Scale, 1932). Twelve attitude statements were given to the participants and the responses were scored. Overall one with a perfect positive attitude would score 55 and above. Of these, any respondent who scored 38 points and above was treated as having positive attitude while those who scored 37 points and below were treated as having negative attitude. Results indicate that 90.9% (355) of the participants had a positive attitude with the proposition that hand washing with soap and running water during food preparation prevents food contamination, 89.6% (345) of the participants had a positive attitude that keeping surface clean reduces risks of contamination however, 46.8% (180) had a negative attitude on the statement that using different cutting boards and knives for raw and cooked foods or ready to eat foods is not necessary.

Further analysis in this results showed that attitude may not be a factor in food hygiene and safety practices ($\chi^2=0.048; df=1; p$ value=0.827).

Table 4: Attitude on Safe Food Handling Practices

<table>
<thead>
<tr>
<th>Attitude statements</th>
<th>Positive Attitude (n %)</th>
<th>Negative Attitude (n %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Frequent hand washing with water and soap during food preparation is essential</td>
<td>355 (90.9%)</td>
<td>35 (9.1%)</td>
</tr>
<tr>
<td>2. Keeping kitchen surfaces clean reduces the risk of food contamination</td>
<td>345 (89.6%)</td>
<td>40 (10.4%)</td>
</tr>
<tr>
<td>3. Washing hands with soap after touching raw meat, fish or eggs before cooking is important.</td>
<td>329 (85.5%)</td>
<td>56 (14.5%)</td>
</tr>
<tr>
<td>4. Using different cutting boards and knives for raw and cooked foods or ready to eat foods is not necessary</td>
<td>205 (53.2%)</td>
<td>180 (46.8%)</td>
</tr>
<tr>
<td>5. Keeping raw and cooked food separate helps to prevent food contamination</td>
<td>326 (84.7%)</td>
<td>59 (15.3%)</td>
</tr>
<tr>
<td>6. Covering cooked food leftovers and ready to eat food does not prevent food contamination</td>
<td>186 (48.3%)</td>
<td>199 (51.7%)</td>
</tr>
<tr>
<td>7. Leftover soups and stews should always be boiled for at least 1 minute before consumption</td>
<td>280 (72.7%)</td>
<td>105 (27.3%)</td>
</tr>
<tr>
<td>8. There is no problem of reheating cooked food leftover more than once</td>
<td>185(48.1%)</td>
<td>200 (51.9%)</td>
</tr>
<tr>
<td>9. It does not matter the cleanliness of the food store where food is purchased</td>
<td>282(73.2%)</td>
<td>103(26.8%)</td>
</tr>
<tr>
<td>10. Inspecting food freshness and wholesomeness is valuable</td>
<td>310(80.5%)</td>
<td>75(19.5%)</td>
</tr>
<tr>
<td>11. It is not proper to throw away foods that have reached their expiry date</td>
<td>298 (77.4%)</td>
<td>87(22.6)</td>
</tr>
<tr>
<td>12. It does not matter if cooked food stays for more than two hours at room temperature</td>
<td>160(41.6%)</td>
<td>225(58.4%)</td>
</tr>
<tr>
<td>13. It is safer to thaw food in a cool place</td>
<td>133(73.9%)</td>
<td>47(26.1%)</td>
</tr>
<tr>
<td>14. It does not matter how long food is kept in the refrigerator as long as the food looks and smells ok</td>
<td>116(64.4%)</td>
<td>64(35.6%)</td>
</tr>
</tbody>
</table>

IV. DISCUSSION

The Level of Consumer Food Hygiene and Safety Practice

The results of this study demonstrated that food hygiene and safety practices were average (42.9%) among households in Langata Sub-County, Nairobi County. This implies there are a big percentage of consumers in Langata who carry out unsafe food handling practices despite having reported high knowledge in safe food handling practices. Several studies reviewed by Redmond & Griffith (2003) reported that consumers carried out unsafe food handling practices which contributed to food poisoning. A study conducted on Mauritius consumers reported 51.3% of consumers having fairly good food hygiene and safety practices Gunsam & Mahomed, (2012).

Separating raw and cooked food is important in minimising food contamination. In this study, results showed that there was a difference between those who practiced good and bad practice. Maybe the difference could be as a result of different knowledge levels, availability of enough utensils and storage areas to enable the consumer the ability to separate raw and cooked food.

Socio-Demographic Factors that Influence Food Hygiene and Safety Practices

Although gender, age, level of education and marital status were not factors influencing good food hygiene and safety practices in this study, literature has shown these factors are relevant (Jevsnik et al., 2008). The findings are similar to a study conducted on consumer food safety knowledge and practices in the home in Turkey by Unusan (2007) who found no statistical significance of demographic profile on food handling practices. In this study, the type of housing was a factor influencing good food hygiene and safety ($\chi^2=14.986, df= 2 p=0.000$). People living in households that were permanent and semi-permanent houses were more likely to be practitioners of food hygiene and safety than those in temporary houses. This might be explained by the fact that, type of housing is a common social economic

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indicator which may suggest stability in terms of resources and facilities for food safety. Agustina et al., (2013) reported that homes in low socioeconomic urban areas in East Jakarta with limited facilities tend to have poor hygiene practices such as using dirty cooking or eating utensils for their children. The absence of basic sanitation facilities in a low socioeconomic family may lead to poor food hygiene and sanitation practices in the households.

The results of this study showed that the number of people in the household influenced food hygiene and safety practices ($\chi^2=10.467; df=3; p=0.015$). Majority of the household had three to four people living together (n=145). In study carried out by Agustina et al., (2013) reported that children belonging to families with more than six household members had 2.3 times higher risk of suffering from diarrhoea. In regards to number of people in a household, Meyenburg et al., (2014) reported insignificant differences but noted that those having a child one year or younger were practitioners. Household with children may adhere to food safety due to their desire to avoid harming children under their care.

The main source of water was a factor influencing practising good food hygiene and safety ($\chi^2=8.163; df=3; p=0.041$). Those with piped water in the houses and piped water in the compound were classified as practitioners than those using boreholes. The least practitioners were those who sourced water from vendors. This probably is because the former have sufficient water for washing while the latter are limited in hygiene and safety practice because of shortage of water. Availability and accessibility of water is an important factor in hygiene practice.

Consumers’ Knowledge on Safe Food Handling Practices

Knowledge of food hygiene and safety is essential for consumers to make informed choices and implement safe food handling practices in their daily lives. In this study, more than half of the consumers were aware of food hygiene and safety practices, although there were gaps in their knowledge. This might be explained by the fact that almost two thirds of the participants had secondary education and above. Similar findings were reported for Mauritius consumers who reported 65% of consumers had adequate knowledge (Gunsam & Mohamed, 2012). In this study, overall consumer knowledge was not a factor influencing food hygiene and safety practices. The findings are similar to studies reviewed by Redmond and Griffith (2003) where it was concluded that knowledge of food safety practices does not always result into implementation of good practice. Other studies have reported otherwise, a survey on consumer information needs on food hygiene and safety (Gunsam & Mohamed, 2012).

High knowledge was revealed in washing vegetables and fruits before eating 95.3%, meat should be cooked until juices are clear 91.4%, storing foods in containers with lids prevents contamination 75.3% and cooked leftover do not need reheating thoroughly before eating 68.6%. Having good knowledge in these factors was found to influence good food hygiene practices. In this study low knowledge was reported by consumers, less than a half were aware that the same cutting board cannot be used for raw cooked foods as long as they look clean. This may be due to lack of alternatives. This is a concern, since major outbreaks are often associated with cross contamination. In qualitative studies conducted by Langiano et al., (2012) and Les Études de Marché Créatec, (2007) indicated that some discussant used separate cutting surfaces for different foods. These findings differ with Gunsam and Mahomed, (2012) who reported high knowledge.

Knowledge that safe water can be identified by the way it looks was found to be a factor influencing good food hygiene and safety practices. Water is an important factor in food hygiene and safety. It is essential for consumers to know that they cannot identify safe water by its physical appearance.

Consumers’ Attitude on Food Safety Practices in the Home

In this study results indicate that majority 79.5% of the respondents had positive attitude towards food hygiene and safety. Further results indicated there was no significance relationship between overall attitude and practice ($\chi^2=0.048; df=1; p$ value=0.827). However, attitude is an important factor besides knowledge in ensuring a downward trend of foodborne diseases (Azmi et al., 2006).

Positive attitude on covering cooked food leftovers and ready to eat food does not prevent food contamination, left over soups and stews should always be boiled for at least one minute before consumption and there is no problem of reheating cooked food leftover more than once did influence food hygiene and safety practices ($\chi^2=59.047; df=1; P=0.000$), ($\chi^2=7.700; df=1; P=0.006$) and ($\chi^2=45.472; df=1; P=0.000$). Participants who had positive attitude in regards to these variables were more likely to have good food hygiene and safety practices.

V. Conclusion

- Unsafe food handling practices were reported like leaving perishable foods at room temperature for more than 2 hours and not covering the head while preparing food in the kitchen.
- Socio-demographic factors associated with food hygiene and safety practices included type of housing, number of people in household and main source of water.
- Knowledge was good but there were gaps in areas such as wiping hands with a reusable towel and the same cutting board can be used for both cooked and raw food provided it looks clean.
- Attitude on covering cooked leftover food prevents contamination was found to influence good food hygiene and safety practices.

Recommendation

- This study revealed that food hygiene and safety practices remain a public health concern. Whereas knowledge is high actions remains low. Therefore improvement efforts through health education can be done to cultivate safe food handling practices. Policy maker need to develop local contextualized guidelines to enhance safe food handling behaviour and practices.
- Attitude that it is not good to throw away expired food was high and it is not important to have background.

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information of store of bought food. This is a significant phenomenon and a public health concern.

- Safe food handling practices that were reported to be poor like covering of the head while preparing meals, leaving cooked food at room temperature for more than two hours and putting leftover cooked foods for more than 3 days in the refrigerator among others reported in this study need to be looked at keenly. This major issue warrants major household education probably through mass media by SMS or household campaign.

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REFERENCES


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A Past, Present and New Features of Digital Notice Board

Gaurav Sattiwale, Rushabh Tongase, Vaidehi Kamble, Rupesh Saut, Prof. Manish K. Shriwas

Electronics and Telecommunication, PRMIT & R, Badnera, Amravati.

Abstract- In any organization or institution a Notice Board is a very important component as it is one of the best mediums to communicate with the individuals of that organization or institution. The System DIGITAL NOTICE BOARD using a GSM is an SMS-based digital display system which has been designed to display a notice in a very attractive manner. The system allows the user to display the message (text or image or video) from anywhere just by sending the text via SMS with an associated password. The sent text is received at the GSM module and enables it to get displayed on LCD screen. The System is an experiment for displaying real time notices.

Index Terms- GSM (Global System for Mobile communication), SMS (Short Messaging Service), LCD (Liquid Crystal Display).

I. INTRODUCTION

The Digital Notice Board comprises of two major units. The first unit is a simple user's mobile handset. The second unit is the control unit. For instance, this system can be achieved with the help of GSM modem and LCD display. The control unit comprises of a display, the Raspberry Pi board and the GSM module. Whenever any information or message have to be displayed the user can send the message via user's mobile phone to the control unit. This smart notice board can be used in many applications including educational institutions, banks, public places like bus and railway stations.

Previously the System had been done using a microcontroller, a 16×4 LCD display and a GSM module. It enabled the user to display a notice by using SMS. No doubt it was a good System with some glimpse of evolving technology but it failed to display the notice in an attractive manner, the number of characters were limited, also the display was too small and couldn’t be implemented for an actual use. Sometimes also there occurred some network problems, leading to slowing down of its process. Some features like an acknowledgment message to user’s phone, feedback signals like LED or a buzzer were further added to make the System more reliable but these features couldn’t improve the control system of the System.

Later, for enabling a colorful display the control system was changed from an ATMEAL microcontroller to an Arduino board. This provided a luxury to interface a big LED or LCD screen as a display component of the System. Moreover this also reduced the process time. Now the process of authentication was also enabled and only authorized user were allowed to display the notice.

Further for displaying the notices in the form of image and for a better speed of operation, the control unit was replaced by a Raspberry Pi Board which was like a mini computer. This change promoted to enhancement of various features. Now the user was not only able to display a notice by using a SMS but also by an Android Application with all facilities of accessing the notice board with a strong authentication system. Further the use of internet was also introduced and now the user was all set to display the notices using a webpage from anywhere in the world. But these advancement in features led a surplus increase of cost.

Our System deals with the displaying of notices on a LCD screen by using GSM technology and the local wireless network. This System also takes care of security concerns also the System mechanism takes care about the records of previously displayed notices. Moreover it helps to display a large size files without any android application. Raspberry Pi is the heart of system, so the focus is to use maximum of its features in a very effective manner.

II. LITERATURE SURVEY

1) GSM Wireless Communication System [2010]:[1] This paper mainly focuses on the application of GSM (Global System for Mobile communications). Advantages and Disadvantages of GSM has been marked here. GSM system is the most famous system for the Second Generation mobile telephony worldwide.

2) Display Message on Notice Board using GSM [2013]:[2] This paper proposes the use of GSM technology for displaying notices on a digital notice board which helps to save time and energy. The notice board is eco-friendly and reduces the use of papers. Information can be given to a large mob in a very effective manner.

3) Wireless Electronics Display Board Using GSM Technology [2013]:[3] This paper explains a photo type laboratory model wireless notice board system. The board is connected with a GSM modem which enables the user to display the notice in public places using SMS.

4) SMART NOTICE BOARD [2013]:[4] This technical paper discusses on the present technology in association with daily life. It explains the importance of the Smart notice board and how efficiently it can be used in day to day life.

5) A Protocol for End-to-End Secure Transmission of SMS [2014]:[5] In this paper the Easy SMS protocol and how it can be successfully designed so as to provide end to end secure communication through SMS is discussed. The analysis shows the focus on security and methods to prevent various attacks. Also it explains the other aspects like communication, bandwidth etc.

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<table>
<thead>
<tr>
<th>System name</th>
<th>Year</th>
<th>Author</th>
<th>Advantages</th>
<th>Limitation</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Message on Notice Board using GSM</td>
<td>2013</td>
<td>Foram Kamdar, Anubbhav Malhotra and Pritish Mahadik</td>
<td>1. we can use in advertisement world. 2. we can use in public utility areas</td>
<td>There is limitation of number of characters used in SMS. LCD Display's used to Notify Notices.</td>
<td>LCD Display's used to Notify Notices.</td>
</tr>
<tr>
<td>Transmission Policies for Multi-Segment Short Messages</td>
<td>2015</td>
<td>Yi-Bing Lin, Sok-Ian Sou</td>
<td>1. Define process of communication. 2. Shows working of SMS (Short message services).</td>
<td>Limited Characters should be accepted while transmitting SMS.</td>
<td>Transmission protocol for SMS service.</td>
</tr>
</tbody>
</table>
III. PROPOSED METHODOLOGY

Technology is influencing every aspect of society and such is the case of an institution. A Digital Notice board is a very innovative System for any institution. In our proposed System, the digital notice board enables the user to display the notices wirelessly. The system uses a GSM module for transmission purpose, connected to a raspberry pi and a LCD screen display. The System consists of a simple voltage regulator circuit for the purpose of power supply to the GSM. For displaying the notice a webpage has been created and user needs to access the page before sending the notice. All the programming related to the Systems had been done using Python. Also a buzzer had been provided so as to get notification of new notice. The Notice board also sends an acknowledgement to the user after display of notice.

At the start, the programs fed are run. After successful execution of the programs followed by entering the correct password the notice board is ready to display the notice. For displaying the notice the user need to send the text via SMS with a set password as prefix. The sent message is received at GSM module, which then transmits it serially to the Raspberry Pi. Finally the message is displayed on the webpage with an IP address.

The System also enables the user to display an image or video using the Wifi of the Raspberry Pi. The user just needs to upload the image or video on an URL and send text with the image or video or name in a set format. Also multiple images can be displayed like a slideshow.

Using a File Transfer Protocol the user can access the database of the notice board from any other PC or Mobile after a suitable authentication. This FTP helps the user to keep the records of the notices and in case it can be displayed again if someday it is missed by majority in the institution.
IV. WORKING

The basic aim of this system design is that the allowed user will send SMS from his mobile phone to GSM module, this message is the notification to be inserted in the website database which is displayed on the monitor.

To receive the message a SIM card is placed in GSM module and this is connected to Raspberry Pi through RS232 serial port. A website is created to display the message received on monitor. The webserver will run itself on Raspberry Pi. A program is written for reading the messages from GSM module and to insert them into the database.

Raspberry Pi will use this program to read the messages using GSM module only from allowed users i.e. users entering password (12345) before the text. And it inserts them into the database of the website which will be displayed on the monitor connected through HDMI port. Thus, Raspberry Pi will act as the central authority of the whole system controlling the website and the GSM module as well. By using HDMI port LCD / LED monitors can be connected. By using a HDMI extension switch, message can be displayed on several monitors at a time. This system is applicable to display messages / notices that need to be regularly updated in industrial areas / college notice boards. It is easy to communicate with serial port and easy to connect databases using a python module. GSM module accepts only certain commands through serial communication and responds to them. These commands are called "AT Commands", AT means attention. There are a set of AT commands to perform different functions, every command starting with 'AT'. In Raspberry Pi, a program is written in python programming language to read the messages from GSM Module through serial connection to link it with a pre-created webpage with address “127.8.0.1:8888” and displays it on the monitor connected.

Moreover images can be displayed on the screen by using a webpage with IP address “10.42.0.1:8888/upload” . The process is enabled by connecting the source of an image i.e. a phone or a laptop via Wi-Fi of Raspberry Pi. After uploading the image it can be displayed on the screen by sending a message starting with “$12345 img:” followed by the image name, e.g. an uploaded image named “PRMITR” can be displayed by first uploading it and sending a SMS as “$12345 img:PRMITR”.
FLOWCHART:

1) For Displaying Notice in the form of a text.

START

Initialize Ports

Enable LCD (Screen)

Incoming message from user’s phone

Raspberry Pi Card

Is there Password before text?

N  Don’t Display Message

Y  Display Message

Send Acknowledgement message to user

END
2) For Displaying Notice in the form of an image or video.

START

Initialize Ports

Enable LCD (Screen)

Upload image or video using IP

Incoming message from user’s phone

Raspberry Pi Card

Is there Password before text?

N

Don’t Display Message

Y

Display Message

Send Acknowledgement message to user

END
V. STEPS TO BE FOLLOWED TO DISPLAY NOTICE:

GENERAL STEPS

STEP 1: Run the program named “app.py” (stored in database) on the terminal. This will launch the web-socket and start the display in the form of a webpage.

STEP 2: Followed by app.py run the program named “chk.py”.

STEP 3: Enter the required password for starting the notice board.

STEP 4: After entering the correct password the status of the GSM module is checked.

STEP 5: If the status of GSM module is OK, launch the webpage of notice board using the allotted IP address on the Browser.

A) DISPLAYING NOTICE IN THE FORM OF TEXT:

STEP 1: Enter the authentication password followed by the notice to be displayed in the textbox of the user’s phone.

STEP 2: Send this text to the authorised SIM in the GSM module connected to control unit of notice board.

STEP 3: The received text is serially transmitted to the control unit and then authentication password is checked.

STEP 4: If the password is correct, the notice will be displayed on the screen with a buzzer notification and simultaneously an acknowledgement will be sent to the user.

B) DISPLAYING NOTICE IN THE FORM OF IMAGE/VIDEO:

STEP 1: The image or video that is to be displayed needs to be uploaded on the database of the notice board using an IP address that is allocated for the uploading purpose.

STEP 1: Enter the authentication password with a prefix “img:” followed by the image name (or video name) of image (or video) to be displayed in the textbox of the user’s phone.

STEP 2: Send this text to the authorised SIM in the GSM module connected to control unit of notice board.

STEP 3: The received text is serially transmitted to the control unit and then authentication password is checked.

STEP 4: If the password is correct, the image (or video) will be displayed on the screen with a buzzer notification and simultaneously an acknowledgement will be sent to the user.

VI. OUTPUT

VII. CONCLUSION

With the day to day advancement in technology the Notice Boards are also evolving from a handwritten system to a digital display and further to a Wireless Display System. The paper reflects a Digital Notice Board System with a GSM module and raspberry pi, which displays the desired notices in the form of a text or an image or video on the LCD screen through a SMS. Multiple notices can be displayed simultaneously in parallel with an image or video. Use of a password scheme before the message and for starting the notice board display has also enhanced the security concerns.
VIII. FUTURE SCOPE

Notices can be displayed in the form of word document, power point, video clips by uploading them directly. This can be done by using a suitable operating system, program files, drivers, players so as to make them more eye-catching. Such notices can be displayed by using a webpage and giving an access to authorised users. The best way is the use of an INTERNET. An IP address can be used to achieve this. The IP will enable the user to upload any notice and from anywhere in the world. Moreover cloud can be used to dump the past notices and keep record of them.

REFERENCES


[4] Shruthi K., Harsha Chawla, Abhishek Bhaduri"SMART NOTICE BOARD".Department of Electronics and Communication, Manipal Institute of Technology, Manipal University, Karnataka


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Titanium and its role in Dentistry

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Abstract- For dental cast restorations like partial dentures, frameworks etc usually base metal alloys were used. This was mainly because of the high price of gold. Despite the desirable properties for framework fabrication, some characteristics, such as corrosion resistance and casting procedures, needed to be improved. Titanium casting technology was thus developed and subsequently got refined over many years. Removable partial dentures are usually affected by fatigue because of the cyclic mechanism of the masticatory system and frequent insertion and removal. Titanium and its alloys have now been used in the manufacture of denture frameworks and also in implants. This article shows the characteristic features of titanium which enables it to be used in dentistry.

Index Terms- Dentistry, Frameworks, Implant, Titanium

I. INTRODUCTION

Titanium (Ti) is a pure element listed in the periodic table with an atomic number of 22 and an atomic weight of 47.9. It is the ninth most abundant element and the fourth most abundant structural metallic element in the earth’s crust, following aluminum, iron, and magnesium. Of the total amount of titanium mined, majority is titanium dioxide which is used as a pigment for use in paint. Only 5% to 10% is used in its metal form.

With advances in dental porcelain in the 1960s and the significant increase in the price of gold in the 1970s, alternative alloys such as palladium alloys and base metal alloys, were developed. The allergenic and carcinogenic properties of base metal alloys used in dentistry especially nickel and beryllium-based alloys, have fueled controversy. The evolution of titanium (Ti) applications to medical and dental implants has dramatically increased in the past few years because of titanium’s excellent biocompatibility, corrosion resistance and desirable physical and mechanical properties. Titanium has become a material of great interest in dentistry in recent years. It has been used a biocompatible replacement for alloys used for fixed and removable prostheses, implants, files etc. Titanium can form several oxides- TiO, Ti₂O₃, TiO₂ – of which TiO₂ is the most common. TiO₂ can have three different crystal structures – rutile, anatase, and brookite – but also can be amorphous.

II. HISTORY

Titanium was first discovered by Williams Gregor, a British minerologist in 1791 who found the metal in a "black magnetic sand" in Cornwall and named it 'MENACHITE'. Martin H. Klaproth, a German chemist and minerologist rediscovered it in 1795 to be known as TITANIUM. He recognized that this metal was identical to the material Gregor had discovered. Dr. Wilhelm Kroll, a refugee from LUXEMBOURG is considered as the “Father of Titanium Industry”. He invented useful metallurgical processes for commercial production of titanium metal, the Kroll process. The United States Bureau of Mines used the Kroll process to produce metallic titanium. Annual production has rapidly increased from 3 tons in 1948 to 20,000 plus tons in the early ’80s.

III. MANUFACTURING OF TITANIUM

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Titanium is produced by heating titanium ore (rutile, ilmenite) with petroleum-derived coke in a reactor at 1000 °C. The mixture is then treated with chlorine gas, forming titanium tetrachloride TiCl4 and other volatile chlorides, which are subsequently separated by continuous fractional distillation in the presence of carbon and chlorine and then reducing the resultant TiCl4 with molten sodium to produce a titanium sponge. This sponge is then fused under vacuum or in an argon atmosphere into titanium ingots. It is often remelted to remove inclusions and ensure uniformity.

Titanium alloys used in dentistry exist in three forms: alpha, beta, and alpha-beta. These types originate when pure titanium is heated, mixed with elements such as aluminum and vanadium in certain concentrations, and then cooled. These added elements are said to act as phase-condition stabilizers. Aluminum has been called an alpha-phase condition stabilizer. Aluminum serves to increase the strength and decrease the weight of the alloy. Vanadium has been called a beta-phase stabilizer. As aluminum or vanadium is added to Ti, the transformation occurs from alpha to beta. The alloy form desired is maintained at room temperature by quenching the alloy. Titanium is available as Commercially pure titanium (cpTi) and as Titanium Alloys. Classification of Titanium is given by American Society for Testing and Materials ASTM (Table 1). Commercially pure titanium (cpTi) is available in four grades (Table 2) which vary according to the oxygen (0.18-0.40 wt.%), iron (0.20-0.50 wt%) and other impurities. Grade 1 being the most pure.

IV. PHYSICAL & CHEMICAL PROPERTIES

**Biocompatibility & Corrosion Resistance**

Titanium's highly reactive nature provides both advantages and disadvantages for its use. Titanium must be melted in a vacuum or under inert gas to prevent oxidation and incorporation of oxygen can lead to embrittlement of the cast metal. Contamination with even low concentrations of atmospheric oxygen can lead to significant loss of ductility. The molten alloy reacts readily with refractory investment materials, therefore the material should be selected carefully. This same reactivity is responsible for many of titanium's favorable properties. The metal oxidizes almost instantaneously in air to form a tenacious and stable oxide layer approximately 10 nanometers thick. This oxide layer provides a highly biocompatible surface and a corrosion resistance similar to that of noble metals. In addition, the oxide layer allows for bonding of fused porcelains. However recently contact dermatitis or granulomatous reactions to titanium is seen in its use in pacemakers, hip prostheses, surgical clips etc. It appears that in rare circumstances, for some patients, the titanium used in dental implants also induced an allergic reaction.

**Strength & Rigidity**

The strength and rigidity of titanium are comparable to those of other noble or high noble alloys commonly used in dentistry and titanium's ductility when chemically pure, is similar to that of many dental alloys. Titanium also can be alloyed with other metals, such as aluminum, vanadium or iron, to modify its mechanical properties. The wrought alloy condition is approximately 6 times stronger than compact bone and thereby affords more opportunities for designs with thinner sections (e.g., plateaus, thin interconnecting regions, implant-to-abutment connection screw housing, irregular scaffolds, and porosities. However toxicity of V has been pointed out. V-free titanium alloys as implant materials have been developed. Most of them are, a type titanium alloys composed of non-toxic elements like Nb, Ta, Zr, Mo or Sn with lower moduli of elasticity and greater strength have been developed recently. Titanium has a relatively high tensile strength; it takes quite a bit of pressure to pull titanium apart. According to Key to Metals, titanium has a tensile strength of between 30,000 and 200,000 lbs. per square inch. The yield strength (170 – 480 MPa) and ultimate strength (240 – 550 MPa) varies depending on the grade of titanium.

**Shape memory**

The nickel-titanium alloy (Nitinol) wires have large elastic deflections or working range and limited formability, because of their low stiffness and moderately high strength. This alloy exists in various crystallographic forms. At high temperature stable BCC lattice (austenitic phase) exists. On appropriate cooling, or on application of stress, this transforms to a close-packed hexagonal martensitic lattice, associated with volumetric change. These characteristics of the austenite to martensite phase transition results in two features of clinical significance called as shape memory and superelasticity, or pseudoelasticity. The use of NiTi for medical applications was first reported in the 1970s. Nitinol [also known as a shape memory alloy (SMA), smart alloy, memory metal, or muscle wire] is an alloy that “remembers” its shape. NiTi has been used in orthopedic and orthodontic implants.

**Low thermal coefficient of expansion**

This property allows titanium to be much more compatible with ceramic or glass materials than most metals, particularly when metal-ceramic or metal-glass seals are involved.
Low modulus of elasticity

The modulus of elasticity of titanium is 5 times greater than that of compact bone, and this property places emphasis on the importance of design in the proper distribution of mechanical stress transfer. The modulus of elasticity of the alloy is slightly greater than that of titanium, being about 5.6 times that of compact bone. The alloy and the primary element (Ti) both have titanium oxide (passivated) surfaces.

Density

The density of CpTi (4.5 g/cm³) is about half of the value of many of other base metals. Titanium is lighter than the stainless steel (approximately 56% as dense) yet has a yield strength twice and ultimate tensile strength almost 25% higher. This gives it a highest strength-to-weight ratio of any metal suited to medical use.

Non-magnetic

Commercially pure titanium and all the titanium alloys are non-magnetic. The physical difference between ferromagnetic and nonferromagnetic materials lies in the degree of magnetization. Titanium is not susceptible to outside interference and won’t trigger metal detector. Another benefit to titanium for use in medicine is its non-ferromagnetic property, patients with titanium implants can be safely examined with magnetic resonance imaging (convenient for long-term implants).

V. USES

Titanium alloys are largely used in industrial applications such as jet engines, air frames, and the aerospace industry, which require high strength-to-weight ratios and good corrosion resistance. Other applications include chemical processing, nuclear waste containment, heat exchange units, seawater desalinization, marine equipment, deep-well drilling, and food processing situations that require resistance to corrosion by chemicals and cleaning agents.

VI. ROLE IN DENTISTRY

ATitaniun has been used in cast dental prostheses since the 1970s. Equipment is available to cast titanium into single-and multiple-unit-crown and-bridge frameworks, implant-supported structures and partial or full denture bases. Cp-Ti presents mechanical properties similar or slightly better than gold alloys type III and IV, nickel-chromium (Ni-Cr) and cobalt-chromium (Co-Cr), normally used in the fabrication of frameworks. Although titanium provides some advantages to these prostheses, the high melt temperature of titanium, 1,672 °C, requires special melt procedures, cooling cycles, investments and equipments to avoid its contamination. Due to the gas absorption and high chemical reactivity of casting, titanium is difficult to be processed through the conventional technique of lost-wax. In high temperatures, it reacts with gaseous elements such as nitrogen, oxygen and hydrogen and forms a thick layer of oxides “alpha case” which may reduce the resistance and ductility of the structure obtained. Due to this, use of a vacuum chamber and controlled environment is preferred. There are three main types of titanium casting systems: casting under pressure/vacuum with separated chambers of melt and casting; casting under pressure/vacuum with a single chamber of melt and casting; and casting under vacuum/centrifugation. Also, dental titanium casting can be accomplished through the methods of centrifugation or pressure/vacuum. The metal is melt with an electric plasma arch or through inductive heating in a chamber full of inert gas or at vacum. The metal is melt and then is transferred to the refractory mould through the centrifuge or through filling under pressure/vacuum. Several equipments are commercially available for casting titanium but their cost is considerably higher than the conventional casting equipments.

Due to these difficulties other techniques were developed to fabricate crowns and frameworks. Such techniques comprise titanium machining from a solid metallic block. The frameworks are all fabricated in titanium grade 2 considering four generations of development. The first generation is based on pre-fabricated titanium cylinders and a bar component, which are joined through laser welding. In the second generation technique, different pieces of titanium components with cylinders are used. After the leveling of the components, a titanium bar is positioned and, then, horizontally laser welded. In the third generation of frameworks, small titanium components are individually cast by a technician for each titanium abutment at the main mould and, then, joined by laser weld. After that, resin teeth are joined or ceramic is cast to the titanium device. In the fourth generation, Procera® titanium frameworks are fabricated in a single piece through machining controlled by a computer. This technique is based on a concept where the technician makes a resin pattern simulating the final shape of the framework, and then this pattern is scanned and its image is generated by a software. Information about the implants positions are also given to the computer. When all data are collected, a framework is machined from a solid block of titanium grade 2, which is only refined and polished by a technician. Following, resin teeth are fixed or a low fusion porcelain is used to fabricate the teeth.

Other techniques of frameworks fabrication through titanium machining are also available. Such techniques utilize the CAD-CAM system and comprise a computed system of restoration/reconstruction that uses a scanning technique primarily in combination with machining techniques of titanium and/or porcelain in the prosthetic laboratory. The different systems can use either CAD-CAM or a wax pattern combined with CAM. Some systems known are: Hint-ELs, Procera, DCS President System, Cad. Esthetics, KaVo.
Everest System, microDenta, Cerconbrain and Cerec. These techniques are based on a model scanning, which is digitalized for the production of a design by the software. This design would represent the final shape of the desired structure. Therefore, through the data obtained from the representation of the final structure shape, the framework is fabricated by industrial machining equipments using a single block of titanium. From this moment, also through the same system described previously, the crowns on the framework are obtained by machining a ceramic block. Laser welding aims to enhance the poorer marginal adaptation of titanium castings, because, besides the difficulties of casting and machining, titanium presents a great difficulty related to the conventional welding due to its high melting point and chemical reactivity. In laser welding, the intensity and duration of laser pulse is such that a sufficient energy can be provided to a junction in order to join the segmented structures and reach a weld point before a high heat is conducted to other parts of the piece. It means that there is a small generation of heat for the piece, except for the point of laser application. Despite of these advantages, Sjogren et al. attested that the chemical composition of the highly reactive titanium is changed in the weld point during laser welding, and this can influence the mechanical properties in this region.29

Role with Dental Implants

Initial utilization of titanium in Dentistry is dated from the 60’s and occurred accidentally. In 1965, the Swedish doctor Per-Ingvar Branemark was investigating the blood microcirculation in rabbits tibiae with an observational camera made of titanium, when he noticed that metal and bone were perfectly integrated, without any rejection, and these cameras were very difficult to be removed. Based on this observation, Branemark developed special cylinders to be implanted in rabbits’ and dogs’ tibiae; which became, later, a secure, modified and optimized base to receive long-term fixed prosthesis in maxilla and mandible for human application. In this same year, a 10-year follow-up study was initiated in Gothenburg, Sweden to evaluate the clinical results from the application of this technique in humans.

Titanium implants have been used with success for years in the substitution of lost dental elements. They can be manufactured both from commercially pure titanium (cp-Ti) or titanium alloys. They have been used for both endosseous and subperiosteal implants. Endosseous implants have taken the form of rods, posts and blades made of either pure titanium or titanium alloys. The passivating oxide on the implant surface permits close apposition of physiological fluids, proteins, and hard and soft tissues to the metal surface. This process, whereby living tissue and an implant become structurally and functionally connected, is called osseointegration. Titanium also has been used successfully as a biocompatible implant material, and continual improvements in both device design and clinical implantation techniques have led to well-accepted and predictable procedures. In 1996, the ADA’s Council on Scientific Affairs updated its position regarding the use of endosseous implants as a treatment modality for full or partially edentulous patients.

VII. CONCLUSION

The physical and chemical properties of Titanium and titanium alloys make it a versatile material in modern Dentistry. Properties like corrosion resistance in oral environments, strength-to-weight ratio, Lightweight, excellent mechanical properties, Biocompatible, Non-toxic, Long-lasting, Non-ferromagnetic, Cost-efficient and Long range availability makes titanium the best material choice for many critical applications. However, although all its advantages, the technologies related to it casting, machining and processing techniques, such as spark erosion, laser welding and micromachining, and computer aided design – computer aided manufacturing are still expensive and with important limitations. Therefore, a wide use of titanium in dental prosthesis will depend on technological advance and more clinical investigations in order to develop more profitable techniques to prove its efficiency.

ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in American English is without an “e” after the “g.” Use the singular heading even if you have many acknowledgments.

REFERENCES

TABLE 1: Standard Specification for Titanium and Titanium Alloys

<table>
<thead>
<tr>
<th>ASTM grade</th>
<th>Unalloyed titanium</th>
</tr>
</thead>
</table>


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<table>
<thead>
<tr>
<th>ASTM grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Unalloyed titanium</td>
</tr>
<tr>
<td>3</td>
<td>Unalloyed titanium</td>
</tr>
<tr>
<td>4</td>
<td>Unalloyed titanium</td>
</tr>
<tr>
<td>5</td>
<td>Titanium alloy (6% aluminum, 4% vanadium)</td>
</tr>
<tr>
<td>6</td>
<td>Titanium alloy (5% aluminum, 2.5% tin)</td>
</tr>
<tr>
<td>7</td>
<td>Unalloyed titanium plus 0.12 to 0.25% palladium</td>
</tr>
<tr>
<td>9</td>
<td>Titanium alloy (3% aluminum, 2.5% vanadium)</td>
</tr>
<tr>
<td>11</td>
<td>Unalloyed titanium plus 0.12 to 0.25% palladium</td>
</tr>
<tr>
<td>12</td>
<td>Titanium alloy (0.3% molybdenum, 0.8% nickel)</td>
</tr>
<tr>
<td>13</td>
<td>Titanium alloy (0.5% nickel, 0.05% ruthenium)</td>
</tr>
<tr>
<td>14</td>
<td>Titanium alloy (0.5% nickel, 0.05% ruthenium)</td>
</tr>
<tr>
<td>15</td>
<td>Titanium alloy (0.5% nickel, 0.05% ruthenium)</td>
</tr>
<tr>
<td>16</td>
<td>Unalloyed titanium plus 0.04 to 0.08% palladium</td>
</tr>
<tr>
<td>17</td>
<td>Unalloyed titanium plus 0.04 to 0.08% palladium</td>
</tr>
<tr>
<td>18</td>
<td>Titanium alloy (3% aluminum, 2.5% vanadium) plus 0.04 to 0.08% palladium</td>
</tr>
<tr>
<td>19</td>
<td>Titanium alloy (3% aluminum, 8% vanadium, 6% chromium, 4% zirconium, 4% molybdenum) plus 0.04 to 0.08% palladium</td>
</tr>
<tr>
<td>20</td>
<td>Titanium alloy (3% aluminum, 8% vanadium, 6% chromium, 4% zirconium, 4% molybdenum) plus 0.04 to 0.08% palladium</td>
</tr>
<tr>
<td>21</td>
<td>Titanium alloy (15% molybdenum, 3% aluminum, 2.7% niobium, 0.25% silicon)</td>
</tr>
<tr>
<td>22</td>
<td>Titanium alloy (6% aluminum, 4% vanadium with extra low interstitials, ELI)</td>
</tr>
<tr>
<td>23</td>
<td>Titanium alloy (6% aluminum, 4% vanadium) plus 0.4 to 0.8% palladium</td>
</tr>
<tr>
<td>24</td>
<td>Titanium alloy (6% aluminum, 4% vanadium) plus 0.4 to 0.8% palladium</td>
</tr>
<tr>
<td>25</td>
<td>Titanium alloy (6% aluminum, 4% vanadium) plus 0.3 to 0.8% nickel and 0.04 to 0.08% palladium</td>
</tr>
<tr>
<td>26</td>
<td>Unalloyed titanium plus 0.08 to 0.14% ruthenium</td>
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<tr>
<td>27</td>
<td>Unalloyed titanium plus 0.08 to 0.14% ruthenium</td>
</tr>
<tr>
<td>28</td>
<td>Titanium alloy (3% aluminum, 2.5% vanadium) plus 0.08 to 0.14% ruthenium</td>
</tr>
<tr>
<td>29</td>
<td>Titanium alloy (6% aluminum, 4% vanadium, extra low interstitial elements, ELI) plus 0.08 to 0.14% ruthenium</td>
</tr>
<tr>
<td>30</td>
<td>Titanium alloy (0.3% cobalt, 0.05% palladium)</td>
</tr>
<tr>
<td>31</td>
<td>Titanium alloy (0.3% cobalt, 0.05% palladium)</td>
</tr>
<tr>
<td>32</td>
<td>Titanium alloy (5% aluminum, 1% tin, 1% zirconium, 1% vanadium, 0.8% molybdenum)</td>
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<tr>
<td>33</td>
<td>Titanium alloy (0.4% nickel, 0.015% palladium, 0.025% ruthenium, 0.15% chromium)</td>
</tr>
<tr>
<td>34</td>
<td>Titanium alloy (0.4% nickel, 0.015% palladium, 0.025% ruthenium, 0.15% chromium)</td>
</tr>
<tr>
<td>35</td>
<td>Titanium alloy (4.5% aluminum, 2% molybdenum, 1.6% vanadium, 0.5% iron, 0.3% silicon)</td>
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<tr>
<td>36</td>
<td>Titanium alloy (45% niobium)</td>
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<tr>
<td>37</td>
<td>Titanium alloy (1.5% aluminum)</td>
</tr>
<tr>
<td>38</td>
<td>Titanium alloy (4% aluminum, 2.5% vanadium, 1.5% iron)</td>
</tr>
</tbody>
</table>

**TABLE 2: Grades for Commercially pure titanium (cpTi)**

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MAXIMUM IMPURITY LIMITS (wt%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nitrogen</td>
</tr>
<tr>
<td>ASTM grade I</td>
<td>0.03</td>
</tr>
<tr>
<td>ASTM grade II</td>
<td>0.03</td>
</tr>
<tr>
<td>ASTM grade III</td>
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Practices, Roles and Challenges of Urban Agriculture in South Western part of Ethiopia: The case of Bedelle town

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Abstract- This study was aimed to assess practices, roles and challenges of urban agriculture in Bedelle town. Through purposive and stratified random sampling methods a total of 60 respondents were selected from the two kebeles of the town. To achieve the objectives of the study both qualitative and quantitative methods of data analysis were used. Descriptive statistics such as percentage distribution, bar graphs, were used. According to the major findings of the study, the major types of urban farming practices in the study area includes; horticulture or production of fruits and vegetables, crop farming or production, livestock rearing such as beef farming, dairy farming and pig farming as well as trees and grass planting. The survey result reveals that there are various significances of urban farming in the study area. Among these, it play a decisive role in generating household income, serve as employment opportunities, contribution to food supply, economic use of land and environmental enhancement, beatification of the town and solid waste management are the major roles of urban agriculture in the area. The result of the study also reveals that the major challenges of urban farming practices in the area includes; lack of access to credit, shortage of inputs, land granting system, lack of technical support from concerned bodies/less contact with agricultural sectors, planting of non edible trees, lack of enough space/land shortage for cultivation, disease, problem of market are the major challenges of farming practices in the area. Finally, suggestions have been forwarded based on the findings of the study.

Index Terms- Associations, Urban, Urban Agriculture, Urban dwellers

I. INTRODUCTION

1.1. Background of the study

The world population is predicted in the near future to live more in urban than in the rural areas for the first time in the history of mankind (FAO, 2001). Obviously our continued existence living standard is influenced by our capacity to provide food for ourselves in a sustainable manner. The increasing rate of urbanization accentuates the vulnerability of cities for extraordinary social and ecological quandaries and bottle neck for feeding their mounting population (Derischer, 1996). Due to the increased urban population in the world exerts pressure on the demand in food (Brown, 2008). This shows that the cities and towns are excessively dependant of food from outside instead of being producer of it for themselves. During such occasion, the low income groups are vulnerable to economic crisis because, from 50-90% of their income goes to food expense only (Karry, 2004). It had revealed also that for the large part of cities in developing countries, creating adequate formal employment options is challenging enterprise. Urban areas in Africa have been beaten by diminishing economies. Live in cities and towns are becoming more expensive, formal employment has declined as well (Kone, 2009).

For such ends urban agriculture is a response to urban predicament, a survival tactic of the rural migrants and for those who are disenchaneted of not find work in the city and they become the ingredient of the raising population of the urban poor (ASC,2006). Despite its long existence and ever present, urban agriculture is still single handed and lacks appropriate attention. It has been ignored by academic, planners and municipal policy makers by neglecting subsistence production activated in domestic economy has not been taken in to account to be of great significance (Smith and Momen, 1987). In most African cities, urban farming is accomplished as an informal sector (Tewodros 2007). Farming in cities is present in anyone, but it is not in the same degree (Kaufman J. and Martin B. 2000). Urban agriculture however, is one of the inherent exciting notions of continuous development because it can address virtually all areas of sustainability.

In contemporary African cities and towns and their surroundings, urban agriculture takes many forms reflecting access to land, availability of water and the potential for bringing other resources in to the production process (Elis and Sumberg, 1998). Despite the availability of such important resources, urban agriculture lacks due attention and it has been single handed for a long time. The many governments of African countries still focused on rural agriculture by ignoring and under estimating it in urban areas (African study center, 2006). However, currently many governments are creating agencies to manage urban agriculture. Among these, Ethiopia, Malawi, Kenya, Tanzania, Uganda, Nigeria, and Zimbabwe are few examples (FAO, 2002).

Irrespective of the work of urban agricultural management agency in Ethiopia, urban agriculture is still a traditional practice and mostly under taking informally. However, it has been the most important part of income for urban farmers in Addis ababa contributing more than 60% of their total household income (Tewodros, 2007). In the study area there are observable urban farming practices. However, instead the nearby rural areas are the predominant sources of such products, even for the urban farmers’ theme production and productivity of urban agriculture in the area is not as such fruitful. Thus, this study focuses on investigating the practices, roles and challenges of urban agriculture in Bedelle town.
1.2. Statement of the problem

In the present day world urbanization is escalating over time in the expense of arable land. Cities throughout the world are facing with unpredictable social, economical and ecological challenges, not slightest of which is how to give to eat their growing population (UN, 2006). In developing nations, rate of urbanization is higher and competing its agricultural land in the nearby rural areas (Drescher, 1996). As being one among the developing countries the situation in Ethiopia is not dissimilar to this general feature. The horizontal expansions of urban centers in general and Bedelle in particular increasingly consume away the rural arable lands.

Urban farming appeared as the prior solution for the situation. Producing food in urban areas will support the rural production of food which is increasingly depleting. Rural migrants are out numbering the urban poor. Farming in urban area can be the coping strategy for such migrants and the urban poor. Properly handled and managed urban agriculture could support the urban community beyond the consumption of producers. Even though, urban agriculture is an important source of vegetables, fruits and other cereal crops in most cities and towns of developed and developing nations. In Bedelle town vegetables, fruits and other cereal crops used by the town population are mostly supplied from rural and distance places like Addis Ababa and other areas of southern nations, nationalities and peoples. This is because of low productivity of urban agriculture in the area although the area has high potential of production in different kinds of urban farming practices. Virtually all urban centers of Ethiopia at large and Bedelle town in particular, unemployment is the challenging problem. However, the effort by the municipality or other concerned officials to fortify farming in the town is limited.

Urbanization and agriculture are mostly considered as incompatible activities that compete expensive urban lands. However, in reality in urban areas, significant amount of land is available for agriculture. In the study area, such vacant lots mainly around homes are found with most of them failed to give production. Back yard gardening is easy to start and to run by the children or women in the house hold who might be marginalized from formal employment (Freeman, 1991). Such yards could produce out puts that can make self sufficient in food the households with such home steadies. Even high yields can be raised even in the simplest of containers (CFSC, 2003). Despite the existence of sticky situation of urban farming in the study area, the researchers didn’t found studies that portrayed the inherent setbacks and opportunities. Hence, the study was conducted to assess the major practices, roles and challenges of urban agriculture in Bedelle town.

1.3. Objectives of the study

1.3.1. Main objective

The general objective of the study was to assess the major practices, roles and challenges of urban agriculture in Bedelle town.

1.3.2. Specific objectives

More specifically, the study has the following objectives:

❖ To investigate the farming practices in the town
❖ To describe the significance of urban agriculture in Bedelle town

❖ To explore the major challenges of urban agriculture in the town

1.4. Significances of the study

Rapid and extensive urbanization of less developed nations is perhaps the most dramatic demographic phenomenon of our modern times. This trend aggravated the number of people living in cities and towns resulting the increase in demand of food supply in the urban settings. The fact in the country in general and Bedelle town in particular is an observable truth. It has the following importance:

❖ Food security: for the question of urban food problems and related difficulties, especially very low access and production of vegetables and fruits in the area, urban agriculture can provide quick answer and remedial solutions to this end.
❖ The study will find out the challenges of urban farming that can set back the performance of farmers, the extent, type and prospects of the urban farming.
❖ Raise the involvement of the growing young population in to urban agriculture by creating employment opportunity.
❖ Planers and municipal policy makers will get important inputs in supporting and planning the urban farming.
❖ The finding also has been believed to be critical to planners to re assess their planning and zonation of areas for agriculture in the town and for the municipality to give more emphasis to urban farming.

1.5. Scope of the Study

Urban agriculture can occur inside the urban centers (intra-urban), or on fringe areas (peri-urban, however, the study was only delimited to urban agriculture taking place in urban areas or urban kebeles of Bedelle town. Issues that were assessed includes; the challenges that hindered urban agriculture from its advancement, the type of farming practicing in the town and the major significances of urban farming were the major issues assessed in this study.

II. MATERIALS AND METHODS

1.1. Study area description

1.1.1. Naming of the town

According to the traditional surrounding Oromo people there is only one view about the original name of the town. According to this view the original name of the town Bedelle derived from the oromo term “Bede” a traditional material that are used for making Enjera. Bedelle town is located in the south western of Oromia national regional state, Illu Ababora Zone Bedelle district. It is located 480 km from Addis Ababa. The town shares boundary with the surrounding pesant administration namely: Mirga mute from the north Ilke and Kerero from the south Bita Mute and Siddisa from the west, Odoo from the west. Astronomically the town located approximately between 8° 17’ and 8° 37’ N latitude and 36°13’ and 36°19’ E longitude.
1.1.2. Research Design

It is important before research is undertaken to create guidelines that would give order and direction to research project. So as to assist the researchers not to lose focus of the research inquiry (Best, 2003). This is done through research design and methodology. The research design was a descriptive type of study utilizing survey method. In this study, the researchers also employed a mixed methodology to assess the practices, roles and challenges of urban agriculture. Both qualitative and quantitative approaches were employed. The existing social world is best studied using several analysis and point of view, which means diverse methodologies are most excellent ways of expressing and assessing the social world (Sarantakos, 2005).

1.1.3. Sampling technique and Sample size

In this study, two types of sampling techniques are employed. These are purposive and stratified random sampling methods. Purposive sampling method was used to determine the study area, the topic under study and farmers who practice urban agriculture. Bedelle town is purposefully selected as a research setting for at least two reasons: First, research works are very little and there are no studies done so far on the issue of urban agriculture in this area. Consequently, the study is partially intended to fill this gap. The second reason is that Bedelle town has been selected as a study area due to the presence of urban agriculture practices. Purposive selection of the topic is due to the fact that in order to ensure livelihood sustainability of urban people of the area, assessing issues related to urban agriculture is important from development perspectives. Again from section of the society, farmers who practice urban agriculture have been purposefully selected given the fact that including all society as study population is difficult.

In order to obtain the sampling units or respondents the researchers employed stratified simple random sampling method. Because it is believed that this method would not affect the representation of the samples as farmers represent from each kebeles and this method gives equal chance of being selected for each farmers. These farmers are stratified according to their Association to conduct the survey in the area. Accordingly, there are 19 Association or Small and Micro Enterprise (SME) in the two kebeles of the town (i.e 7 from 01 and 12 from 02) and the total farmers are 194. The researchers selected 60 farmers for the study. The farmers are selected from each stratum by using simple random sampling and by applying the principle of proportional sample selection method. The sample size in each stratum is proportional to the size of stratum.

3.2.3. Nature and Sources of Data

The nature of the data was qualitative and quantitative. Both primary and secondary data sources were used. The primary sources of data for this study were collected from sample households that practice urban agriculture, municipality workers and traders that supplies the products of urban agriculture from the town or in the outside, unemployed youths in the town. The secondary sources of data were collected from various published and unpublished documents of the municipal and urban agriculture department office, CSA data, and woreda and kebele public administration offices of Bedelle town.

3.2.4. Data Collection Instruments
Primary data collection methods /tools/ were: questionnaire, interviews, field observation, FGD, Global Positioning System (GPS) and photographs.

3.2.4.1. Data analysis and Interpretation Techniques

The collected raw data were systematically organized, summarized, processed and interpreted using appropriate data analysis techniques to make them meaningful and to draw sound conclusion based on the research findings. Hence, in this study, the data collected via various methods of data collection instruments are analyzed, summarized, and presented through qualitative and quantitative methods. The data collected through questionnaire are quantitatively tabulated, interpreted and presented by using certain statistical methods such as frequency distribution, tables and bar graph, percentages, maps, pie chart were used for the analysis of the data collected. The analysis is made by using SPSS version 20 and Ms Excel. The data collected through interview, personal observations and focus group discussion are analyzed qualitatively.

III. RESULTS AND DISCUSSION

3.1. Urban Farming Practices in Bedelle Town

In urban areas of Bedelle town, the farmers’ conducts different types of agricultural practices in view of increasing their income through different ways. Farmers who reside in the town raise their income manifold through carrying out different farming practices around the town and within the hinterland of this town. Farmers of the area conduct various farming activities and use to feed their families as well as sell agricultural product for cash profit which in turn enable them to earn money. During the survey, information on what types of farming activities are practiced in the town were collected from selected households or sample respondents, from town communities and through onsite inspection (field observation). Moreover, secondary data sources were collected from municipality of the town and district offices of the town kebeles. The feedbacks received from these sources revealed that there are various urban farming practices in the area understudy. There are 19 Associations that practices different types of urban farming practices in the two kebeles of Bedelle town (i.e 7 from 01 and 12 from 02). In addition to this, some individuals practice urban farming in the area lonely.

3.1.1. Horticulture [fruits and Vegetables Farming]

It is kind of urban farming practices in the area which is concerned with the production of fruits and vegetables. A wide varies of plants are cultivated for their edible leaves, roots, fruit and seeds. Vegetables provide important minerals and vitamins in human nutrition and add variety as well as interest to our meals. Vegetables are grown in the area in the environments ranging from urban areas (City windows boxes) and home gardens to larger farm practices. Most of the fruits crops are harvested in the area by hand and oxen for home consumption and commercial purpose (sale). The field survey indicated that in the two kebeles of the town different types of vegetables and fruits are producing as an integral part of farming system of the study site. Farmers of the area (town) organized themselves in Small and Micro Enterprise (SME) and practice various farming activities while others individually (lonely) practice farming activities in the area. As can be seen from the table above, there are two associations that practice horticultural farming practices. In these kebeles Vegetables and fruits are grown as sole or intercropped with other vegetable or cereals. The most common vegetables that are produced in the study area include cabbage, lettuce, carrot, onion, garlic, sweet potato, potato, Augio (kororima), and the common produced fruits area banana, mango, sugarcane, Avocado are the most common ones.

Figure 4.3: Banana production, photo by researchers, 2014
3.1.2. Crop farming practice (crop production)

There are also wide varieties of crops growing in the town and in the hinterland of Bedelle town. Crop farming is also another type of farming practice that are commonly observed in the area such kinds of farming activity is carried out to feed the farmers family and for market purpose. As information obtained from the key informants and sample respondents, the most common types of crop farming practice involves crops such as, maize (corn) and beans. These farming activities are practiced by group of people who form association (SME) in the two kebeles of the town; there are also other individuals who lonely practice this farming. During the survey it was observed that farmers of the area practice crop farming by intercropping with other vegetables and crops. These farming activities are practiced by Walif and Kamise Association in kebele 01. In the area such crop farming activities are practiced by informal households at the back of their backyard and hinterland of the town.
Livestock farming practice

Livestock production is an important component of agriculture activities in developing countries like Ethiopia. Such types of farming activities are kept in both urban and rural areas of the country for various uses including milk and milk products, meat, eggs, food, cash and various cultural uses (Power et al., 2004). Livestock farming play decisive role as they offer opportunities for risk of copying, farm diversification and intensification and provide significant livelihood benefits (Bossio, 2009). Livestock farming is an integral part of farming system and has major economic and social functions in the country in general and urban people of Bedelle town in particular. The field observation also indicated that there are various types of livestock breeding in the area such as cattle rearing (cows, oxen, calf), sheep and pig rearing. In the area understudy such types of farming practices are mainly categorized into followings. These are:

- Beef farming,
- Dairy farming and
- Pig farming

Picture: 4.11: pig farming practice in the area, photo taken by researchers, 2014

Picture 4.12: Dairy and beef farming practices, photo by researchers, 2014
In general, the most common types of farming practice in the study area includes: Horticulture (fruits and vegetables), Crop farming (crop production), Livestock farming, Beef farming, Dairy farming, Pig farming, Tree and grass planting.

There was also a poultry farming practices before a year for many years, however, currently, poultry farming activity was halted as information obtained from some households and people of the area. Onsite inspections during the survey also revealed that poultry farming has halted the practices of poultry farming.

3.2. Significances of urban farming in the study area

The survey result reveals that there are various significances of urban farming in the study area. Among these, it play a decisive role in generating household income, serve as employment opportunities, contribution to food supply, economic use of land and environmental enhancement beatification of the town and solid waste management are the major roles of urban agriculture in the area.

3.3. Challenges of urban Agriculture in the study Area

Results of the survey indicate that constraints on the urban agriculture in Bedelle are various. The major determinant factors are: Access to inputs, Inability to get land and its granting system, Absence of allotment gardening, Priority to non edible trees in urban areas, Seasonal rain, Disease, Fragmentation of members group gardening, Market Accessibility, Availability and access to credit, Health risks, Lack of technical support from the concerned body, Lack of training.

IV. CONCLUSIONS AND RECOMMENDATIONS

3.4. Conclusions

Agriculture is the back bone of Ethiopian economy or it is basis for the entire socio-economic structure of the country and has major influence on all other economic sectors and development process of the country. It accounts 50% of the GDP of the country and also provides employment for about 85% of the total working labour. Moreover, it accounts 90% of the total foreign exchange earnings (WB, 2000). This implies the life of the country’s society who lives both in urban and rural areas overwhelmingly depends on agriculture. Even though agricultural activities are mostly practiced in rural parts of Ethiopian; there are also practices of in urban agriculture in urban parts of the country in general and Bedelle town in particular.

In urban areas of Bedelle town, the farmers’ conducts different types of agricultural practices in view of increase their income through different ways. Farmers who reside in the town raise their income manifold through carrying out different farming practices around the town and within the hinterland of this town. Farmers of the area conduct various farming activities and use to feed their families as well as sell agricultural product for cash profit which in turn enable them to earn money. During the survey, information on what types of urban farming activities are practiced in the town were collected from selected sample respondents, from town communities and through onsite inspection (field observation). Moreover, secondary data sources were collected from municipality of the town and district offices of the town kebeles. The feed backs received from these sources revealed that there are various urban farming practices in the area understudy.

According to the major findings of the study, the major types of urban farming practices in the study area includes;
horticulture or production of fruits and vegetables, crop farming or production, livestock rearing such as beef farming, dairy farming and pig farming as well as trees and grass planting. There was also a poultry farming practices before a year for many years, however, currently, poultry farming activity was halted as information obtained from some households and people of the area. Onsite inspections during the survey also revealed that poultry farming has halted the practices of poultry farming in the area understudy.

The survey result reveals that there are various significances of urban farming in the study area. Among these, it play a decisive role in generating household income, serve as employment opportunities, contribution to food supply, economic use of land and environmental enhancement. Beatification of the town and solid waste management are the major roles of urban agriculture in the area. There are different factors that affect/limits the practice of urban agriculture. The potential of urban agriculture in the Bedelle town is constrained by the limitation of various determinant factors. In most cases, the problem of access to the key ingredients that could make the urban agriculture in Bedelle successful is not physical but instead administrative. For instance, lack of land or the way they granting land, problem of finance, animal disease, lack of training, problem of the cooperation between the urban agriculturalists, the municipal offices, veterinary professionals, micro and small scale enterprises and trade and industry offices are the basic and critical problems of urban agriculture in the area. However there are also other factors that limit the production and productivity of the sector in moderate level in the area like market, group fragmentation and others, allotment gardening, priority to give to non-edible trees, seasonal rain fall and access to inputs are also contributing factors. Therefore, alleviating such problems will improve the productivity and production of urban agriculture.

3.5. Recommendations

The finding of the study indicates that lack of external support (financially, technically as well as other incentive provision) from different stakeholders such as municipality of the town, Agricultural sectors of the woreda is very decisive to enhance urban farming practice in the area. Lack of collaboration of animal health, municipality and trade and investment offices with the associations is another problem. Therefore, good and frequent contact, assistance and relationship is basic for increased production and productivity.

Awareness creation that are most effective in increasing the capacity of different partners to engage them in urban farming practices plays a paramount roles in mitigating the problem of unemployement in the area understudy. Therefore, the provision of training and awareness creation for the local communities and other concerned bodies is found to be very important to encourage such farming practices in the area.

The problem of land is the first critical problem for associations and also individuals. Therefore, the woreda Administration in collaboration with municipality of the town should create a conducive environment to solve the problem of land shortage for urban agriculture. Because there is no problem of land in the town but the way of granting is the basic problem.

- Provision of credit for those who are willing to participate in such farming is found to be essential to solve the problem of financial constraints that hinders the practices of urban farming.
- The majority of plantation trees are non edible. Therefore, converting plantations to be edible and make them dual purpose is the basic thing.
- Creating market opportunity especially, pig production in various ways is essential.
- Finally, it is researchers’ conviction that the above mentioned recommendations if implemented will combat the challenges of Urban agriculture in the area if not fully, at least partially.

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REFERENCES


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Event2U e-commerce platform – Enabling mosques as integrated, holistic, comprehensive Centre-of-Excellence in enhancing the Muslim community’s wellbeing

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Abstract- This paper proposes a conceptual solution to enrich the mosque’s role as an ideal integrated center towards a holistic & comprehensive mosque by providing effective services and facilities through an e-commerce platform (Event2U). Event2U is a Consumer-to-Consumer (C2C) business model which aims to provide a platform for vendors, mosque and event planner to promote their services and facilities to the customers as well as a One-Stop Centre for the customers to find the best and highest quality services and facilities that suited their event requirement. This system provides a platform for advertising services and facilities only, whereas the process of transaction occurs outside this system. Nine blocks of Business Model Canvas (BMC) framework, Literature Review, strategy canvas, value proposition design (VPD) and environmental map have been used as the methodologies for this paper.

Index Terms- one-stop centre, advertising, facilities, e-commerce, on-line platform, Network of Mosque [NOM], BMC, VPD

I. INTRODUCTION

During the prophet’s time, the Mosque was meant not only for performing prayers at formally appointed times, but also for many other religious, social, political, administrative and cultural functions. However these days the functions of the mosques are not as vibrant as the prophet’s time [1]. The mosque should always contains as many purposeful and serviceable components and facilities as possible to create a more effective community center as this will encourage the Muslim society to build an attachment with the mosque which will make them frequently visiting the mosque. Thus, to achieve these powerful missions, the role of the mosque should be made viral and should be a mainstream among the Muslim society. Event2U has a great potential to enhance the quality of the mosque as One-Stop Centre which then will improve the social welfare for the society as well as generate an income to upgrade the mosque infrastructure.

II. BACKGROUND

Nowadays, the Internet has known as a powerful advertising and marketing tools for many companies to do commercial transaction or well known as e-commerce while promoting and selling their goods and services at once all around the world, anytime and anywhere. Besides, e-commerce cover a wide range of numerous types of businesses from a small scale of business to a big scale such as retail services, music site, event services or exchanges goods and services between companies. Therefore, people presently tend to buy or do anything online. But based on the observation and current scenario, it seems like the role of mosque is uncommonly promoted in any platform of e-commerce especially in event management platform. Even though nowadays, people especially Muslims start to make a mosque as a place for them to organize an event but unfortunately it is still oddly enough in e-commerce world.

III. PROBLEM STATEMENT

Not every mosque has its own specific online platform that they can used to promote and advertise the services and facilities provided by them. Therefore, not many people are aware of those facilities or services that they provided as many assume that mosque is only for the purpose of Ibadah. Thus, Event2Us is the best solution for this problem as it acts as an e-commerce platform that gives opportunities for the mosque to enrich it role as effective one-stop centre for the community by promoting the services and facilities that mosque provides. Through this platform, mosque can expand their market as well as generate more income to improve social welfare and mosque infrastructure.
IV. LITERATURE REVIEW

- **ievent.biz**

Inspired Events was founded in 2008 located at 25-1a, Jalan 109e, Taman Desa Business Park, Kuala Lumpur, Wilayah Persekutuan 58100 Malaysia. The purpose of Inspired Events is to build a full-service event management agency that focuses on corporate events. Therefore, the only center of this agency's customer segment is corporate or private sector. This agency has experienced conducting plenty of professional events such as awards nights, gala dinners, concerts, family days, product launches, exhibitions, roadshows, launch parties, conferences, media events and many more. Its mission is to be a Centre of Event Management Excellence in Malaysia and globally where creativity and quality is the heartbeat of the organization.

In Inspired Events, one of the value proposition that they try to deliver to their targeted customer is they offer a complete yet professional event management starting from the strategy and planning of the event, the venue selection, the caterer, security, accommodation and all until event debrief, evaluation and reporting. Besides, they also offer few services such as graphic design for invitations and banners, room styling and theme, lighting & audio design and many more other services that surely will please their targeted customer. Plus, they also provide technical and production as one the their value where they will ensure the technical part will run smoothly, safely and securely during the event.

One of the way for Inspired Events to keep interacting with their targeted customer is through their official website at www.ievents.biz. This website is utilized by this agency to promote their biggest objective, mission and vision. Plus, they also use this website for the targeted customer to view all the services they have and see the feedbacks from their previous clients. Through the website, they have a feature that link the page to their social media accounts such as Facebook, Twitter and Google Plus. Moreover, they also provide a feature named ‘Contact Us’ where the visitor of the website is free to ask anything regarding of their services and agency or discover any new job opportunities. Basically, the purpose of this website is to advertise their services and agency only. If the customer wants to ask anything, they can either email them or directly contact them through the contact number as stated in the website.

![Figure 1: The interface of ievent.biz](image)

- **essentialwerkz.com**

Essential WerkzPte Ltd was established in 2001 based in Singapore. It is an integrated marketing and event management company that manage and organize all types of high-standard events such as corporate event meeting, dinner and dance, product launches, media launches, exhibition, road show and many more. Furthermore, Essential WerkzPte Ltd is offering the highest standards and goals to all the marketing needs. Therefore, this event services company is focusing on the company, corporate or organization as their targeted customers.

In Essential WerkzPte Ltd, the value propositions that they try to deliver to their valued customers by claiming themselves as an essential marketing partner in brand building in pursuit towards business excellence by providing ideas that will help their customers’ marketing campaigns. They will try their best to give to their customers ideas that work. Besides, this company also provides few services such as marketing services, direct marketing services, event services, logistics and warehousing, web solutions and many more in order to ensure their company able to fulfill their customer’s’ needs. Plus, they also offer a timely support event management where they render any help that needed by their targeted customers in the shortest possible time.

Essential WerkzPte Ltd uses their official website essentialwerkz.com, LinkedIn and Facebook as a channel to keep interacting with their customer segments by exposing and promoting their values to the potential customers. This website consists of the background of the company and the team that work for it. Plus, this website also utilized by this company to establish their association and membership with Singapore Association of Convention and Exhibition Organizers (SACEOS), Association of Small and Enterprises
(ASME) and Asian Federation of Exhibition and Convention Associations (AFECA). However, the customers can not use the website to directly interact with the team but customers can contact them through the contact information given in the website.

An-Nahdhah Mosque was officially opened to public on 6th January 2006 in Bushan, Singapore. The vision of this mosque is to guide the community and its mission is to change the lives of people especially Muslims around the circle area. Therefore, one of their customer segments is particularly Muslims community since the mosque’s committees are aiming to serve both religious and spiritual needs as well as providing a platform for the Muslims community to gather and do any other social activities. Besides, parents with children in the age of kindergarten are also one of their customer segments because this mosque has their own kindergarten whereby parents can send their child in the age of 4 to 6 here to learn both academic and Islamic teaching too. In addition, the mosque’s committees are also aiming anyone who wants to volunteer to be part of the mosque’s committees. Those volunteers will help the mosque’s committees to organize any events or programs that can strengthen the bond and engage the mosque’s committees and the Muslims community around them through the spirit of volunteerism. Plus, they are also searching for anyone who wants to donate for the mosque as one of their customer segments since funds are needed for the maintenance of the mosque.

An-Nahdhah Mosque offers few values proposition to attract people especially Muslims community around Bushan area. One of the value that An-Nahdhah Mosque committees try to offer is by providing a ‘one-stop’ center where anyone can use and rent the facilities and venue in the Mosque for any events. This mosque also has a 2-storey building named Harmony Centre to showcase Islamic exhibitions, artifacts and all the information about Islamic civilization and lifestyle. The purpose of Harmony Centre is to expose and attract Muslims community to know about Islam. Plus, few volunteer activities have been organized by the mosque committees to attract Muslims youth to mosque. Those activities also will train the volunteers to be the leader in example, knowledge seeker and build a strong network with other people. Besides, the mosque offer few values for kindergarten children whereby they are not only learn about academic matters in kindergarten but they also will be exposed with Islamic teaching such as adab, akhlak, tajwid and many more as well as Islamic programs such as MaulidurRasul, IsrakMikraj and many more.

One of the channels that are used by An-Nahdhah Mosque community to keep connecting with people around them is through official website at www.annahdhah.org and also social media which is Facebook and Instagram. They utilize the use of these channels to promote upcoming and previous events or programs at An-Nahdhah Mosque.
• **Event Space**

Event space is basically focusing on corporate event where they offer a service to organize any corporate event and program. One of their customer segments is event venues that provide a venue with facilities and caterer services such as hotels, conference centers, resorts, homestays and many more. Plus, full-time event planners are also listed as one of their customer segments. Basically, full-time event planner will responsible to organize and manage the internal flow of the event starting from the preparation until the end of the event. In addition, companies that need to host any events is also one of the customer segments.

Event space offers few value propositions to all of their potential customers in order to attract them such as it gives event planners a forum to keep interacting with one another directly. Plus, Event space is also providing a place for previous customers to give their review, feedback and rating. This is helpful to event planner and event venue and caterer services in order to gain their potential customer confidence and trust with the offered services. Plus, it will also inspire them to do better and keep improving their services while maintaining their previous positive records.

In Event space, they use their official website as a primary channel to keep interacting with the potential customers. Besides, social media which is Facebook, Twitter, and Instagram also used for the customer relationships between Event space and their customer segments. Event space also guaranteed professional services for their customer segments. Hence, Event space are working hardly to develop a functional website with a good UI and build customer base among end users and active vendors as their key activities. There are two key resources that event space keep as their assets which are financial and professional team. They use their financial source to grow and develop a professional team and sales force especially their engineers, human resources team that are accountable in maintaining the organization and business.

Event space’s key partner is Amazon AWS. They use service from Amazon AWS to maintain the infrastructure and store database. In addition, Event space mostly spends their money to fix the organization and business. They need money to develop a professional team and overhead administrative since they have to go for training, workshop and many more. Thus, Event space gain their revenue by charging some fees from event venues and companies need to pay some to Event space whenever they access to the site. Figure 5 shows the Current Business Model Canvas of Corporate Event Space which is one of the examples of event management e-commerce system.

![Figure 4: The interface of Event Space](image_url)
V. STRATEGY CANVAS

Figure 5 shows the strategy canvas that has been applied to create a new market space as well as to make the competition irrelevant between the current systems.
VI. INNOVATOR’S DNA BEHAVIOUR

According to Furr, N. & Dyer, J. (2014), Innovator’s DNA Behaviour is one of the methodologies that can be used to broadly search for the opportunities and insights on customer’s needs as well as the problems worth solving. Through the current business model canvas of the Corporate Event Space, the status quo has been challenged in order to create and refine new ideas as well as to bring a new tangible product to the marketplace. What if mosque becomes one of the customer segments? Mosque can be one of the venues for the event too. Therefore user will have variety of choices to choose the venue to hold an event. Why the customer segment limited only for event planner and caterer? Customer segment can be broadening by having more customer segment such as vendors and service providers. Why not open for individual customer instead of focusing to corporate event? Individual customer also can be potential customer who wants to use services to organize an event. Instead of using social media or mobile application, why choose website as primary channel for all segment? Nowadays, the number of mobile phone user is increasing due to the advancement of technology. Therefore, using mobile application can be one of the strategies of marketing to attract more users to use this event management services. Why using Yelp and WOM as outsourcing company rather than employed your own employee to manage the data and do marketing? Outsourcing is a good alternative, but building your own expertise among the employees is more beneficial for long term process. Then, why develop a functional site with good UI are one of the key activities? Lastly, why not company pay for the employees based on the number of booking made by the customer instead of companies pay for the employees to access the site (per-person or corporate rate)?

Based on the observation from the current Business Model Canvas and some existing platforms that work similar as event2u, the researchers found that network-of-mosque or the role of mosque as one of the platform for people especially Muslims to organize any event is still not well-known and ‘strange’ in any event management e-commerce platform nowadays. Besides, Muslims in Malaysia are not fully utilized the use of Mosque because they tend to think a mosque is just a place to organize religious events such as solemnization, wedding and spiritual events only. Therefore, the researchers realize that event2u as an opportunity to enrich the role of mosque as ‘one-stop’ center for Muslims as in the era of Prophet S.AW. Through event2u, people especially Muslims can organize any event such as exhibition, conference, bazaar, product launch, concert and many more.

In order to explore more on the customer’s need and problem, some interviews has been conducted where the interaction with diverse of people and customer segments occur in order to get new ideas. Mosque’s committee fully supported the idea of enriching the role of the mosque through this e-commerce platform. The interviewee also believes that through this opportunity, the quality of the mosque as community development center can be enhanced. Apart from that, it will also give huge benefits to the mosques as it can help the mosque to generate an income to upgrade the mosque infrastructure.

VII. ENVIRONMENT MAP

- **Key trends**

According to Frost and Sullivan (2015), “Malaysia to have 125 million connected devices in 2025 with over 58 million mobile subscribers. Ninety-five percent of all netizens, or internet users, will be active social network users, presenting a huge potential for digital marketing and ecommerce” (p.10). Therefore, Event Management using technological platform such as website and mobile application to promote services for various type of events which can helps vendors and event planner to expand their business and attract more customer to visit their sites. In addition, based on Frost and Sullivan (2015), “Social networking users in Malaysia are expected to nearly double to 25.6 million in 2020. Around 95% of Malaysian netizens will be part of social networking services” (p.47). From these statistic, it can be conclude that more internet user will using services provided and advertised in internet rather than visiting physical shop. Hence, promoting event management through website and mobile application are expected to be more reliable and profitable nowadays and in future.
• **Market forces**

E-commerce is one of the most preferable methods nowadays to promote products or services in the cyber world. In addition, e-commerce is expected to generate profit in our economic sector. According to Frost and Sullivan (2015), “Sales from online retail (eTail) to grow seven-fold to US $6.1 billion in 2020, riding on the high smartphone and internet penetration, along with rising disposable, income in Malaysia” (p.14). It shown in the figure below:

![Figure 8: Online retail market: Online Shopping trends, Malaysia](image)

• **Macro-economic forces**

Internet economy is becoming bigger and bigger due to the technological development and the increasing number of internet users nowadays. According to Frost and Sullivan (2015), “The internet economy (iGDP) market is expected to contribute 16% (US $90 billion) to the GDP by 2025, up from 4.3% in 2010 as the importance of internet and digitally-connected solutions grows in the economic” (p.13).

![Figure 9: Internet Economy market: Market size, Malaysia](image)

• **Industry forces**

Event management industry becoming more popular as organizing an event becomes a trend nowadays. Apart from that, vendors or company are using social network to promote their services. There are many competitors in this industry; however there are not many platforms which promote event services from various types of vendors and also the mosque. Thus, Event2U come out with a different concept by promoting the mosque as a one stop centre to organize an event. This concept of combining the services from vendors, event planner as well as the mosque as a centre to organize events, make Event2U differ from the other competitors.
VIII. INITIAL BUSINESS MODEL CANVAS

Figure 10 shows the initial business model canvas of Event2U which has been produced.

![Initial Business Model Canvas – Event2U](image)

IX. INITIAL VPD

After exploring the customers’ needs and problems, the value proposition canvas which consists of value map and customer profile has been created. This value proposition canvas is believed to create value for Event2U’s customers as well as lowering the risk of failure. The objective of the value map is to describe explicitly how the products and services create value to the customers whereas the customer profile visualizes what matters to the customers in a sharable format.

www.ijsrp.org
Figure 10: Initial value proposition canvas for customer

Figure 11: Initial value proposition canvas for vendor
Primary research has been conducted through interview and questionnaire to gather more information from specifically target desired groups which are the customer segment of Event2U. The interaction with diverse people and customer segments helps Event2U in getting new ideas. Customer segments including vendors, customers, event planners and mosque’s committee have given their cooperation in answering the questionnaire and interviews. One of the respondents of the questionnaire is an event planner who has the experience of planning an event for more than two years. Besides providing services as an event planner, they also have their own services such as caterer, make-up, bridal dais and many more. They are using social media such as Facebook and Instagram to promote their services instead of using formal platform such as website. Usually they are taking charge according to a few packages provided that suitable with allocated budget from their customers. Some of the event planner use to collaborate with other vendors such as caterer and service providers. Lastly, they are very interested to use a platform such as website or mobile application to advertise their services and get customer feedback.

In the meantime, questionnaire also shows that most of the vendors prefer to use social media such as Instagram, Facebook and Twitter to not only promote their products or services but to directly interact with customers and get feedback or review from them. Plus, the vendors stated that the customers’ demands are the most challenge that they need to face while dealing with the customers through social media. Besides, the survey shows that vendors will use e-commerce platform with the concept of ‘one-stop’ center if it able to attract a big cluster of people, save time and cost. Meanwhile, the result from interviewing the Mosque’s committee shows that the mosque actually has a lot of facilities that they provide for the Muslim community. However, some of the facilities provided by them have quite limited space to accommodate a large number of people which will be less conducive to hold certain events. Thus, the mosque needs some income to upgrade the infrastructure so that it will give more opportunities to the community to organize their events there. Mosque’s committee fully supported the idea of enriching the role of the mosque through this e-commerce platform and feel that it will be a great idea to promote their services too. The interviewee also believes that through this opportunity, the quality of the mosque as community development center can be enhanced. Apart from that, it will also give huge benefits to the mosques as it can help the mosque to generate an income to upgrade the mosque infrastructure.

The result from the customer survey in the figure 13 shows that about 64% from the customer has experienced in using services to help them organize an event, while another 36% never use any event management services. Based on the figure 14, three customers use
social media to find vendors or event planners, while another four customers prefer to directly meet the vendors face-to-face. The services that they need the most from the vendors are caterer, event planner and photographer/videographer. However, from the result in the figure 16 shows that the highest constraints faced by the customer while organizing an event are limited budget and time as well as lack of quality services from the vendor. Figure 17 shows that if there are specific platforms such as website or mobile application that provide event management services, 91% of the customer will use it. Lastly, the result shown in the figure 18 shows that there are a few features on the website or mobile application that are preferable by the customers such as an online booking system, variety of choices, feedback page and online payment.

Figure 13: Experience in using services

Figure 14: Type of platform used

Figure 15: Type of services needed
**Figure 16: Types of constraints**

- Limited budget: 91%
- Limited time: 9%
- Difficult to find right service: 0%
- Lack of quality: 0%
- Others: 0%

**Figure 17: Website or mobile app as one-stop-centre platform**

- Yes: 0%
- No: 91%

**Figure 18: Type of features**

- Variety of choices
- Review, rate and feedback
- Online payment
- Online booking
XI. CONCEPTUAL SOLUTION

ENHANCEMENT BUSINESS MODEL CANVAS

<table>
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<tr>
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<th>Key Activities</th>
<th>Value Propositions</th>
<th>Customer Relationships</th>
<th>Customer Segments</th>
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<td>3. Payment processor</td>
<td>3. Save their valuable times on finding the suitable service for their event.</td>
<td>3) Promotional offer</td>
<td>3) Mosque - Organizer</td>
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<th>Channels</th>
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<td>2. High quality vendors and event planner</td>
<td>1) Social media</td>
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<td>3. Professional and trusted Network-of-mosque (NOM)</td>
<td>2) Website</td>
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<th>Cost Structure</th>
<th>Revenue Streams</th>
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<tbody>
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<td>1) Technological setup and running cost</td>
<td>1) 15% commission from vendors and event planner upon every booking</td>
</tr>
<tr>
<td>2) Marketing expenditure</td>
<td></td>
</tr>
</tbody>
</table>

![Enhancement Business Model Canvas – EVENT2U](image)

**Figure 19: Enhancement Business Model Canvas Event2U**

A. **Customer Segment**
As in Figure, Event2U lists Mosque as one of the targeted user in Customer Segment’s block.

B. **Value Proposition**
Enrich the mosque as one-stop centre for people especially Muslims to organize any event such as solemnization, wedding, product launch, exhibition and many more.

C. **Channels**
Mosque is able to communicate and interact with other customer segments to promote their services and facilities through Event2U.

D. **Customer Relationship**
Customer relationship is basically describing the value that a company offers to maintain the relationship between the company and other customer segments. Any offers or promotion from Mosque will be advertised directly through Event2U website and social media. Plus, other customer segments can view the review, rating and feedback about the services and facilities from the previous customers.

E. **Key Resources**
Key resources describe the assets needed by company to assure the business model works properly. Those resources are a good technological platform, high quality of vendor and event planner as well a trusted and professional network-of-mosque.

F. **Key Activities**
Key activities are also one of the vital block for a company run successfully. As for Event2U, it includes building vendor’s network and managing customers, marketing and customer’s acquisition.

www.ijsrp.org
G. Key Partners
Key partners describe the network of suppliers and partners that a company associate with to make the business works. Thus, the key partners of Event2U are event planners, vendors, mosque, payment processor, hosting company.

H. Cost Structure
Cost structure explains the cost that must be spent by the company in order to maintain the business. For Event2U, the cost comes from technological setup, running cost and marketing expenditure.

I. Revenue Stream
Revenue stream explains the revenue will be generated. Basically, revenue will be generated by charging 15% commission from each vendor and event planner for every booking made by the customers.

XII. ENHANCEMENT VPD
Figure 20 shows the value proposition canvas for the customer. Event2U can helps the customer to easily find the services that they want as Event2U acts as one-stop center platform which provide a lot of choices in choosing the vendors. After conducted survey to the customer, the job matters the most to them are to choose services, make booking and make payment. The problems that usually face by them when organize an event are limited budget, lack quality of services and limited time to find suitable vendor or event planner. The gains that matter the most to the customer are save time, variety of choices and easy payment. Therefore, the solution is to have a website and mobile application that have ‘one-stop-center’ concept which provides services from professional vendors and event planners. This platform must have features which allow them to review the feedback from previous customer and make price comparison.

![Value Proposition Canvas for Customer](image-url)
Figure 21 shows the value proposition canvas for vendor. Event2U provides a platform for the vendors to promote their services for various types of events. This platform acts as a solution for the vendors to promote and expand their business widely. In event2u, one of the customer segments is vendors. Basically, vendors are those people or business that provide event services or products such as photographer, videographer, event decoration, food baked, door gift, emcee and many more. For customer’s profile, the researchers have discovered the job of vendors through event2u. Through this e-commerce platform, vendors can expand their business to another new level. If before this they use social media to promote their services, now they can use event2u to widely promote their business. Plus, they can also interact directly with the customer and get feedback, review or ranting from their previous customers. Based on researcher’s view, vendors have face few problems in promoting their services or products because there is no trusted and formal e-commerce platform for them to really advertise theirs. In addition, vendors also have a challenge to reach their customer segment especially those small vendors since their brands are still unfamiliar among customers. Besides, vendors need to compete with other competitors in order to survive in the business industry. Furthermore, researchers find out about the gains that vendors can get through event2u. event2u will help vendors in promoting and advertising their services or products widely, assist vendors to find their potential customers. Thus, event2u will be a specific platform for the vendors to expand their businesses widely in term of promoting and advertising. Meanwhile for the value map, there are few values event2u has offer to vendors. event2u will provide a ‘one-stop’ center platform for vendors to advertise their services or products worldwide in anytime and anywhere. Plus, since event2u will be a ‘one-stop’ center platform, it can be a pain reliever to vendors in order for them to expand their business and make this platform as an opportunity to introduce their business to the potential customers. event2u will promote vendors’ products or services through website, mobile application, as well as event2u’s official social media especially on Facebook, Twitter and Instagram.

Figure 21: Enhancement value proposition canvas for vendor
Figure 22 shows the value proposition canvas for event planner. Besides promoting the services provided by the event planner, Event2U also provides the list of vendor that can be selected by the event planner to ease their job. Based on the survey that have been conducted, the jobs matter the most to the event planner are interact with the customer, provide services and analyze customer feedback. While the pains that matter the most to them are they need to compete with other event planners and limited platform to advertise their services. Then, the gains that event planner expected are to promote services widely and find various type of vendors. As a solution, the pain reliever that event planner need the most is one-stop center that can save time and review customer feedback. Therefore, a specific platform such as website, mobile application and social media are the suitable to solve this problem.

Figure 23 shows the value proposition canvas for mosque. Event2U helps to promote mosque as one stop centre to organize an event. Based on the customer profile, Event2U try to do some research to understand the mosque better in terms of their jobs, their pains and their gains. The pains of the mosque that can be identified are they have limited services and facilities thus resulting in limited events that can be hold due to not enough capacity. Through Event2U, the job of the mosque will be much easiers it will have specific platform to interact directly with the customer and get feedback, review or ranting from their previous customers. The gains that the mosque will get are the opportunities in promoting various kind of services and facilities, enhance the function of the mosque, attract people to the mosque and can generate income for mosque’s khairat fund which will be a great help in improving the social welfare for the society as well as upgrading the mosque infrastructure. Based on the value map that has been design in value proposition canvas for mosque, the products that Event2U will offer to the mosque are an e-commerce website, Mobile Application for Android & OS and social media platform. Apart from that, Event2U also evaluate on how exactly the products and services alleviate specific mosque pains. Thus, the idea of making the mosque as a One-stop Centre platform is believed to be a pain reliever to the mosque. This concept of One-Stop Centre will be an opportunity for the mosque to promote their serviceable components and facilities as possible to create a more effective community center. Thus, this will relieve the pain of the mosque to build an attachment of people to the mosque. In terms of how Event2U create mosque gains is, through Event2U the mosque will become more efficient as it will enrich their roles in Muslim Community which is not just a place for ibadah but also a place for many purposeful events. Event2U will also help mosque in saving their times as not many mosque has their own corporate website or social media platform to market their services and facilities.
In conclusion, this conceptual solution can give benefits and provides new opportunities for the mosques in Malaysia by making it possible for them to promote their facilities and services to a larger Muslim society in the region and the country. As the development of internet is resulting in great growth of online advertising, e-commerce platform such as Event2u will be a great help in advertising the mosque’s role to become an effective One Stop Centre. As a result, this will encourage the Muslim society to build an attachment with the mosque as it has been narrated in a hadith by al-Bukhaari, no. 620; Muslim, no. 1712; and others: “One of the 7 types of people who will be under the shade of Allah’s Throne on the Day of Judgment is a person whose heart is always attached to the masjid.” In the future plan, Event2U are going to develop a complete business plan by applying V2MOM (Vision, Values, Methods, Obstacles and Measures) Model.
REFERENCES


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I. INTRODUCTION

Health Friendly agriculture is viewed in as sustainable agriculture. It is large protective health shield encompassing different methods of balancing the eco-system via, production, products, philosophies, permanent culture creation, Nutritional Organic Health Friendly, agro-organic agricultural processes follow inherent ecological non-interference and total integrity. Certified Organic Health Friendly production is a market-based arrangement in which farmers certify to consumers that their farm products have followed standardized set of guidelines from NOHFCA (Organic Health Friendly certification agency). The classification is either “natural” or of “synthetic” origin. Finally, there is good reason to understand how Organic Health Friendly agricultural practices in general are right on track towards providing the necessary soil conditions that promote foods with good, and sometimes even superior, nutritional qualities. It should be clear from the novel qualitative tests and concepts outlined herein, that alternative agriculture has made significant contributions to non-traditional concepts and practices relating to soil health and food quality. There have been many studies of what influences consumers in their decisions to purchase or consume Organic Health Friendly foods, mainly concerned with fresh Organic Health Friendly foods. These show a discrepancy between attitudes and behavior with people being positive about Organic Health Friendly foods but often not purchasing them. This discrepancy seems to be explained by the fact that consumers do not consider “Organic Health Friendly produced” to be an important purchase criterion, that Organic Health Friendly foods are not perceived to surpass conventional foods regarding taste and shelf life (two qualities rated to be of great importance), and because of the perceived premium prices of Organic Health Friendly foods. Health Friendly agriculture may be viewed in much the same way as sustainable agriculture; i.e., a large umbrella under which many different methods of production, products, and philosophies exist. The goal — permanent culture, deep Organic Health Friendly, farming systems designed to take advantage of inherent ecosystem integrity, farms which exist on current and non-polluting resources, etc. — may be viewed as a continuum that encompasses a broad spectrum of agricultural concepts and practices that strive towards ecological health rather than one pre-determined production system set in stone for all time. On the other hand, certified Organic Health Friendly production is somewhat arbitrary. It is a market-based arrangement in which farmers certify to consumers that their farm products have followed an approved set of guidelines set forth by an Organic Health Friendly certification agency. Such guidelines assume the production of pesticide-free or otherwise healthy products because they are based on a list of approved versus restricted fertilizers and pest control products. However, the classification of these products — whether they are of “natural” or “synthetic” origin — is arbitrary. That is, a farmer may be certified if he or she meets the specified guidelines. The assumption is that an Organic Health Friendly farm will by necessity follow good husbandry practices such as humus management and mineral supplementation that result in good quality foods, but that is not always or necessarily the situation, especially on early-transition Organic Health Friendly farms. Secondly, in a discussion of “Organic Health Friendly versus conventional” production as it relates to food nutrition, one should not lose sight of the many farms and alternative farming systems that follow the principles...
of Organic Health Friendly agriculture, but do not follow certified Organic Health Friendly production practices. Finally, there is good reason to understand how Organic Health Friendly agricultural practices in general are right on track towards providing the necessary soil conditions that promote foods with good, and sometimes even superior, nutritional qualities. It should be clear from the novel qualitative tests and concepts outlined herein, that alternative agriculture has made significant contributions to non-traditional concepts and practices relating to soil health and food quality. There have been many studies of what influences consumers in their decisions to purchase or consume Organic Health Friendly foods, mainly concerned with fresh Organic Health Friendly foods. These show a discrepancy between attitudes and behavior with people being positive about Organic Health Friendly foods but often not purchasing them. This discrepancy seems to be explained by the fact that consumers do not consider “Organic Health Friendly produced” to be an important purchase criterion, that Organic Health Friendly foods are not perceived to surpass conventional foods regarding taste and shelf life (two qualities rated to be of great importance), and because of the perceived premium prices of Organic Health Friendly foods. Deteriorating Environment and Shortage of Resources, has weakened its capabilities to combat natural adversities and incurred many droughts and floods year after year.

While the term “sustainability” is not a household word yet, it is an umbrella term for six key values: healthier, local, social responsibility, environmental responsibility, simple living and control. Each value has unique sentiments that evolve as consumers’ experiences with the external world change over time. While affluent regions and social classes struggle with surplus production and surplus consumption, close to one fifth of the global population lives in a state of constant undernourishment. In many regions subsistence production of basic foods is restricted by lack of access to capital, land and water. At the same time, more favored growing areas within the same countries are used for commercial production of specialty crops or animal feed destined for export to affluent regions. Thus the major constraints to achieving universal food security, now enshrined as one of the Millennium Development Goals (MDGs) are found in social, economic and political conditions more than in problems regarding productive capacity. The main solutions to food security problems will therefore be found in social, economic and political improvements. Nevertheless, demand for food will increase in the future, and choices about production methods do also influence access to food, so there are reasons why production issues need to be addressed.

II. MATERIALS AND METHODS

Research included study of trends in the food industry, and interviews with distributors, retailers, food service representatives and farmers. The study examined the processing, logistical, and distribution, challenges for small-to-midsize companies; and makes recommendations for farmer-owned or farmer-involved businesses.

This research examined the markets in the food service sector to identify:
1. Potential growth opportunities,
2. Product categories with the most market demand and potential,
3. Requirements needed to meet customer expectations, and
4. Lessons learned from other grower-owned businesses.

Shift to Values-based Purchasing

In addition to health, ‘values’ are also an increasing factor in consumer purchase decisions. Recent consumer research conducted by The Hartman Group indicates there is a very large consumer segment, as high as 75%, showing at least some preference for products that represent their values. These consumers seek emotional validation from the products they purchase, and want to demonstrate their values through their purchases. This shift towards values-based purchasing is occurring in consumer markets around the world. In response to pressure, companies have introduced new product sourcing criteria and management policies. Some companies are taking a proactive stance on issues in order to promote a positive public image, reduce risks, reduce costs, introduce new brands and capitalize on emerging markets.

III. ANALYSIS & REPORTING

1. Non eye-tracked Accompanied Shop (AST) screener (adapted for eyetracking shopping quotas)
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**AGE: (WRITE IN)**

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**GOOD MIX OF AGES**

**GOOD MIX OF LIFESTAGES:**

- Pre family
- Family
- Post family (Empty nesters)

**SOCIAL GRADE (UK)**

- A
- B
- C1
- C2
- D
- E

**ALL RESPONDENTS ABC1C2 E – A GOOD MIX PLEASE**
FSA
FSA non eye tracked ASTs
SCREENING QUESTIONNAIRE

Good morning/afternoon/evening, my name is ................ from Ipsos MORI, an independent market research agency based in London. We are conducting a project with consumers and I wonder if you would like to take part? Could I ask you a few questions to see if you would be eligible for the study? If you are, we’ll be inviting you to participate in this research.

Female 1  Male 2

Q.1 Do you or anyone in your family / close friends work in any of the following fields?

<table>
<thead>
<tr>
<th>ADVERTISING AGENCY</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARKET RESEARCH</td>
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<tr>
<td>JOURNALISM / PRESS</td>
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<td>MARKETING</td>
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<tr>
<td>PSYCHOLOGY / SOCIOLOGY / ANTHROPOLOGY</td>
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<tr>
<td>WHOLESALE/RETAIL MANUFACTURE OF FOOD OR ALCOHOLIC DRINKS</td>
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<td>Any medical field, St John’s, doctor, pharmacist, etc</td>
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<tr>
<td>Any nutritionalist or dietician</td>
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<tr>
<td>Any graphics design or package design field</td>
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</tbody>
</table>

→ IF RESPONDENT OR ANY FAMILY OR CLOSE FRIENDS WORK OR ARE INVOLVED IN ANY OF ABOVE FIELDS OR PROFESSIONS → CLOSE

Q.2a What is your current occupation, and in which field?

WRITE IN: ____________________________

Q.2b And the occupation of your partner / spouse? And in which field?

WRITE IN: ____________________________

Q.3a Have you ever participated in a group discussion, interview or accompanied shop for market research?

- YES................................................ G0 TO Q.2B, C, D
- NO................................................ G0 TO Q.3

Q.3b How many times have you participated in a group discussion / interview / accompanied shop?

NOTE NUMBER ____________

IF 3 OR MORE ASK. How long ago were these?

Q.3c When did you last participate in a group discussion / interview / accompanied shop?

NOTE ____________________________

NB = NON ELIGIBLE IF HAVE PARTICIPATED IN ANY GROUP DISCUSSION / INTERVIEW / ACCOMPANIED SHOP WITHIN THE LAST 6 MONTHS

Q.3d What was the subject of the last group discussion / interview / accompanied shop you took part in?

NOTE ____________

NB= NON ELIGIBLE IF PARTICIPATED IN GROUP DISCUSSIONS/INTERVIEWS ON RETAILERS/SUPERMARKETS OR FOODSTUFFS
Q.4 Can you tell me which of the following represents your current life stage?

- Single, living with parents
- Single living in flat/house share
- Single/married/cohabiting with no children
- Single/married/cohabiting with children
- Single/married/cohabiting - all children adults and living away from home

Check quotas

Q.5a Who is responsible for the bulk of your household’s grocery shopping?

- Me, principally
- My partner / other household member and I jointly
- My partner, exclusively

Q.6a (For info)

Is this store, the store that you…

- currently use most regularly for the bulk of your grocery shopping
  (i.e. where you tend to spend the most on food and groceries i.e. weekly /fortnightly / monthly shop)

- currently use most regularly for top-up grocery shopping?

- Store you occasionally/infrequently use for the bulk of your grocery shopping
  (i.e. where you tend to spend the most on food and groceries)

What store(s) do you use most regularly/frequently for the bulk of your grocery shopping

NOTE

- Store you occasionally/infrequently use or top-up grocery shopping?

What store(s) do you use most regularly/frequently for your top-up grocery shopping

NOTE
Many studies regarding consumer preference and attitudes have taken place internationally. The Soil Association provided a classification of the Organic Health Friendly consumer based on eight attributes; frequency of purchase, the number of categories sought, frequent consumers, who were generally older, more affluent however, research shows the highest spenders are younger and more affluent. However, price is a top barrier for consumers not purchasing Organic Health Friendly products however other barriers include availability of products, price perception, merchandising techniques and the visual product quality (Padel & Foster, 2005). Tsakiridou, Boutsouki, Zotos, and Mattas (2007) study looked at Greek consumers and their preference for Organic Health Friendly products. Six hundred and sixty consumers were surveyed to explore attitudes and behavior of Organic Health Friendly products. The findings indicate majority of the respondents showed a favorable attitude toward purchasing Organic Health Friendly products. Seventy-seven percent are not satisfied with the variety of Organic Health Friendly products at their supermarkets. Quality was found to be the single more important attribute in purchasing Organic Health Friendly products. (Tsakiridou et al., 2007).

Consumer motivation to purchase Organic Health Friendly food products comes in many forms. One’s health is one of the major reasons. Baker, Thompson, and Engelken (2004) study
reveals as an adult, choosing an Organic Health Friendly diet may reduce the risk of Parkinson’s disease. Furthermore, in a study of over 600 people (Baker, Thompson, & Engelken, 2004), those exposed to pesticides had a 1.6 times greater risk of developing Parkinson’s disease. Another study published in Environmental Health Perspectives in 2009 found substituting Organic Health Friendly fruits and vegetables in children ages 3-11 years old had lower organophosphorus pesticides in their urine. By choosing to feed a baby an Organic Health Friendly diet is said to have many health benefits including lowering a baby’s risk of asthma and allergies, decreasing chances of parents having selective or picky eaters, improving baby’s digestion and immune system and decreasing exposure to toxic chemicals (Protecting the next generation, 2009). In Germany, the main reason for consumer motivation to use Organic Health Friendly products stems from distrust in conventional foods (Baker et al., 2004).

Honkanen, Verplanken, and Olsen (2006) investigated ethical motivations in 1,643 Norwegian consumers’ choice for Organic Health Friendly foods. The three motives studies were political, religious, and ecological. It appears that the more people are concerned with animal welfare and animal rights; there was a strong influence on attitudes toward purchasing Organic Health Friendly products. Therefore, the demand for Organic Health Friendly products may be enhanced by appealing to consumers ecological and ethical beliefs. The authors believe ethical values are an important consideration when explaining consumer attitudes toward the purchase of Organic Health Friendly foods. This study investigated the differences between gender and attitudes toward Organic Health Friendly products both fresh and packaged. Descriptive statistics for the study included an analysis for variance (ANOVA), t-test calculations, and chi square was used to determine if there was a significant difference in attitudes toward Organic Health Friendly products and international consumers. On the Organic Health Friendly products survey, questions thirteen and fourteen used a Cronbach’s Alpha to check for bias in the respondents’ answers. The instrument in the study was a fifty five question survey that examined a series of demographic variables ranging from age, income, educational levels, ethnic groups, and college major, and the preference of Organic Health Friendly products, spending on groceries, understanding the costs associated with purchasing Organic Health Friendly foods and the types of products purchased when grocery shopping.

A convenience sample of Respondents as per profile chosen, was drawn upon from a large private University from campuses located in four states in the United States of America. The student body sample was selected from the main campus with over 10,000 students from at least sixty countries with an international student population over 900 students. The majority of students are from China, South Korea, India, Thailand, Saudi Arabia and Turkey. The survey was sent out to the entire population in order to collect as many international students. The 56 questions survey instrument on consumers’ purchasing preferences for Organic Health Friendly products was administered online using SNAP Survey Software (proprietary software) to administer an online survey. The survey responses obtained though SNAP were converted to SPSS for data analysis. In total, two hundred and sixty nine surveys were completed for this study. The surveys were administered via a web link for respondents to fill out. There were two incentives for completing the survey; two respondents had the opportunity to win a twenty-five dollar gift card to Barnes & Noble. The two winners were randomly selected based on using a random number generator though Excel. The two winners were contacted via email.

The research hypotheses are as follows:

H1: There is association between demographic factors and attitude.
H1a: There is a negative relationship between age and attitude.
H1b: There is a positive relationship between women and attitude.
H1c: There is a positive relationship between education level and attitude.
H1d: There is a positive relationship between income and attitude.
H1e: There is a positive relationship between presence of children in household and attitude.
H2: There is association between demographics factors and the frequency of Organic Health Friendly food consumption.
H2a: There is a negative relationship between age and the frequency of Organic Health Friendly food consumption.

The Proposed Framework

The research hypotheses are as follows:

H1: There is association between demographic factors and attitude.
H1a: There is a negative relationship between age and attitude.
H1b: There is a positive relationship between women and attitude.
H1c: There is a positive relationship between education level and attitude.
H1d: There is a positive relationship between income and attitude.
H1e: There is a positive relationship between presence of children in household and attitude.
H2: There is association between demographics factors and the frequency of Organic Health Friendly food consumption.
H2a: There is a negative relationship between age and the frequency of Organic Health Friendly food consumption.

Demographic Factors
a. Age
b. Gender
c. Education Level
d. Income
e. Presence of
Children in household
Health
Consciousness
Organic Health Friendly Food
Knowledge
Attitude
Consumption of Organic Health Friendly products
Environmental Concerns consumption.

H2b: There is a positive relationship between women and the frequency of Organic Health Friendly food consumption.
The research hypotheses are as follows:
H1: There is association between demographic factors and attitude.
  H1a: There is a negative relationship between age and attitude.
  H1b: There is a positive relationship between women and attitude.
  H1c: There is a positive relationship between education level and attitude.
  H1d: There is a positive relationship between income and attitude.
  H1e: There is a positive relationship between presence of children in household and attitude.
H2: There is association between demographics factors and the frequency of Organic Health Friendly food consumption.
  H2a: There is a negative relationship between age and the frequency of Organic Health Friendly food consumption.
  H2b: There is a positive relationship between women and the frequency of Organic Health Friendly food consumption.
  H2c: There is a positive relationship between education level and the frequency of Organic Health Friendly food consumption.
  H2d: There is a positive relationship between income and the frequency of Organic Health Friendly food consumption.
  H2e: There is a positive relationship between presence of children in household and the frequency of Organic Health Friendly food consumption.
H3: There is a positive relationship between attitude and the frequency of Organic Health Friendly food consumption.
H4: There is a positive relationship between health consciousnesses and the frequency of Organic Health Friendly food consumption.
H5: There is a positive relationship between environmental concerns and the frequency of Organic Health Friendly food consumption.
H6: There is a positive relationship between Organic Health Friendly food knowledge and the frequency of Organic Health Friendly food consumption.

The Proposed Framework
The research hypotheses are as follows:

The ten-item Likert type scale to measure environmental consciousness was adapted from Kraft and Goodell (1993) and expanded to 10 items with another research (Cheung, 2005) to examine personal health and diet.

In Part 3, a six-item Likert-type scale to measure health consciousness was adapted from Kraft and Goodell (1993) and expanded to 10 items with another research (Cheung, 2005) to examine personal health and diet.

Social Science (SPSS) was applied. Different data analysis methods are as follow:
1. Reliability Test was employed to determine the Cronbach’s alpha of attitude towards Organic Health Friendly food, health consciousness and environmental concerns. The resulting alpha coefficients of the three variables are 0.835, 0.830 and 0.840 respectively, which all above the minimum acceptable threshold of 0.7 suggested by Nunnally (1978). The reliability test is contained in Appendix 4.1 for reference.

2. Frequency counts and descriptive statistics were used to summarize the result of respondents.
3. Regarding attitudes towards Organic Health Friendly food, One-way ANOVA was employed to find out the significant differences between each of the five demographic factors.

4. One-way ANOVA, independent sample T-test and Linear Regression were used to examine the relationship between the independent variables (demographic factors, health consciousness, environmental concerns, Organic Health Friendly food knowledge) and dependent variable (frequency of label usage).

5. Chi-square analysis and independent sample T-test were applied again to investigate the significant differences between users and non-users on their demographics, health consciousness, environmental concerns and Organic Health Friendly food knowledge.

For all analysis, a probability level of <0.05 was considered significant.

IV. ANALYSIS AND FINDINGS

4.1 Demographics

In this research, a total of 330 questionnaires were collected. A description of respondents’ demographic profile is shown in Table 1.

The samples consist of 147 male (44.5%) and 183 female (55.5%). The age group 16-25 constitutes the largest proportion of the sample with 122 respondents (37.0%), while “66 or above” has the smallest number with 5 respondents (1.5%). Most of the respondents are well educated, with 174 of them (52.7%) having obtained at least higher education or above. In terms of occupation, students with 89 respondents have the biggest share (27.0%). In the sample, 152 respondents (46.4%) are married while 169 (51.2%) are single. 220 of the respondents (66.7%) live with their children and 112 (33.9%) has 4 members in a household. Besides, 125 respondents (37.9%) fall into the personal income group of earning less than $5,000 per month. Yet, 138 respondents (41.9%) indicated that their family monthly income is more than $30000.

In terms of Organic Health Friendly food consumption frequency, 265 respondents (80.3%) claimed that they are buyers of Organic Health Friendly food. Of those 252 users, the majority of respondents, with the number of 166 (50.3%) stated that they “sometimes” use the label, which indicate the consumption of Organic Health Friendly food has not yet become a usual practice for general consumers.

V. RESULT & DISCUSSIONS

The majority of the respondents have a positive attitude towards Organic Health Friendly food. However, over 50% of them indicated that they seldom consume Organic Health Friendly food. Despite the fact that a portion of the consumers claimed that they will spend more on Organic Health Friendly food in the future, most of them spent only $51-$200 on Organic Health Friendly food in a year, which reflect Organic Health Friendly food, still, as a niche market in Hong Kong.

The socio-demographic profile of Organic Health Friendly food buyers are revealed as women buying more frequently then men. Although age is not an important factor, consumers aged between 36-45 shows the highest frequency in the consumption of Organic Health Friendly products (Davis et al., 1995). It was explained by some studies that although younger consumers has a higher willingness to buy due to their greater environmental concerns, they cannot always afford it, and therefore being replaced by the mid-age group who has higher financial power (Fotopoulos and Krystallis, 2002, Baker et al., 2002, Solomon et al., 1999). Households with the presence of children are also found to consume Organic Health Friendly food more often. The reason behind may be perceived as a higher level of concern in food safety with the presence of children, especially for women.

As expected, people who are more health conscious, environmental friendly and have higher level of Organic Health Friendly food knowledge are also confirmed to purchase Organic Health Friendly food more frequently. The item “I worry that there are harmful chemicals in my food” has the highest mean value of 3.93 in the health consciousness scale implies a general high awareness in the threat of food safety. Together with the 3 highest-mean-valued attitudes of Organic Health Friendly food of being “healthier”, “safer and more reliable” and “are of higher quality”, an opportunity in the expansion and raise of the Organic Health Friendly food market can be seen. In term of price premium, nearly 70% of the consumers denoted a willingness to pay a premium for Organic Health Friendly food. Among them, the most bearable price premium is evaluated at a 1/4 price level higher than non-Organic Health Friendly conventional food. All these seem contradictory to the phenomenon that Organic Health Friendly food is surprisingly consumed at a low frequency level. The reason behind can possibly be explained by some of the findings of the survey. Among the attitudes towards Organic Health Friendly food, the statements “it is difficult to identify real Organic Health Friendly products”, “Organic Health Friendly products labels in the market are confusing” and “Organic Health Friendly products are very expensive” scored the lowest in mean values. They can be interpreted as the main reasons failing Organic Health Friendly products in becoming popular, which coincide with rationalizations in past researches (Dent and McGregor 1994, An BordGlas 1991, Stopes and Woodward 1988, Dixon and Holmes 1987, von Alvensleben and Altmann 1987). This suggests a space for development or improvement in areas of price competitiveness and Organic Health Friendly food labeling certification.

Other negative attitudes towards Organic Health Friendly food include “few Organic Health Friendly products available in the market”, “small variety of Organic Health Friendly products” and “few selling locations for Organic Health Friendly products”. These negative attitudes act as barriers for consumption of Organic Health Friendly products (An BordGlas 1991, Stopes and Woodward 1988; Jolly et al. 1989).

While talking about the difficulty in identifying real Organic Health Friendly food products and labels, the study about Organic Health Friendly knowledge brings a lack of knowledge on Organic Health Friendly food into light. The average score of 4.98 out of 10 reveals lack adequate information in identifying real Organic Health Friendly food products and labels. Over 70% of the respondents mixed up the product management certification ISO9001 with Organic Health Friendly.
certification and did not know that Organic Health Friendly-certified labels represent real Organic Health Friendly products. There is also a serious misunderstanding about a higher nutrition content and the use of animal excretion as fertilizers in Organic Health Friendly food which are both actually false. Past studies have pointed out that such a misunderstanding in Organic Health Friendly ways of production will prevent consumers from buying Organic Health Friendly food (Verdurme et al., 2002, Worner and Meier-Ploeger, 1999) In environmental aspect, the overall mean of environmental concerns is 3.44 which represent a fair to moderate level of environmental concerns of the general public. The same association has been captured by Fotopoulos and Krystallis (2002). However, it is generally recognized that there are also numerous barriers to the diffusion of environmentally friendly products, like Organic Health Friendly food, despite the green trend in consumer values and attitudes. The most common barriers stressed in the marketing literature include consumer's reluctance to pay higher costs, both in terms of money and in time and effort, their skepticism regarding the higher quality of these products (Vindigni et al., 2002) and the lack of availability of these products (Lea and Worsley, 2005). Therefore, marketing should be carefully handled to avoid collision of such barriers.

Eight independent factors were considered to examine the relationship between demographics of gender, major, age, income, level of education, and ethnic groups of Respondents as per profile chosen, consumers with their preference for the use of Organic Health Friendly foods. Out of eight hypotheses, many yielded significant findings for the demographic variables analyzed. There were significant findings for gender for their preferences to eat fruits and vegetables often and their preference for recycled products. For the majors in the study, the areas of significance included their preference for Organic Health Friendly foods over non-Organic Health Friendly foods, and the location they prefer to do their grocery shopping. For the year at college, the significant findings included preference for Organic Health Friendly foods, and the reasons for consuming Organic Health Friendly foods. For income levels, the areas of significant findings included the reasons for purchasing Organic Health Friendly products, and product characteristics. For age, the significant findings included the times they’ve purchased Organic Health Friendly foods in the last month, reasons for consuming Organic Health Friendly foods and lifestyle characteristics. For education, the significant findings included the perception of whether it’s worth it to pay more for Organic Health Friendly products over non-Organic Health Friendly products, reasons for consuming Organic Health Friendly products, and the food they most often consumed. For ethnicity, the significant findings included their cost perception of Organic Health Friendly foods over non-Organic Health Friendly foods and the types of food most often consumed. The final hypothesis, environmental science showed a significant finding food safety and product characteristic such as product appearance and certification of its production methods.

The following are significant findings across specific survey questions related to the demographics of the study:

- **Shopping**: Older more educated graduates with high income are solely responsible for family grocery shopping. (p=.001)

- **Preference**: High income American graduates majoring in accounting or management or marketing and retail or culinary and technology prefer Organic Health Friendly grown produce and other Organic Health Friendly foods over non-Organic Health Friendly foods. (p=.045)

- **Worth paying**: Graduates with high income that are older with more education that are either Black (African American) or Asian feel it’s worth paying more for Organic Health Friendly products and for the types of products consumed (fruit, vegetables, milk, yogurt, cheese and cereal). (p=.026)

- **Taste**: Graduates with high income who are more educated indicated their reason for consuming Organic Health Friendly products was because the Organic Health Friendly taste better. (p=.044)

- **Environmental**: Older more educated graduates indicated their reason for consuming Organic Health Friendly products was because they are environmentally conscious. (p=.019)

- **Fruit**: Graduates that are older more educated who were White, Caucasian, Asian and Hispanic/Latino indicated the types of foods most often consumed, Organic Health Friendly fruit. (p=.026)

- **Vegetables**: Graduates that are older more educated who were White, Caucasian, Asian and Hispanic/Latino indicated the types of foods most often consumed, Organic Health Friendly vegetables. (p=.037)

- **Milk**: Graduates that are older more educated and White, Caucasian, Asian and Hispanic/Latino indicated the types of foods most often consumed, non-Organic Health Friendly milk. (p=.037)

- **Cheese**: Undergraduates who are between 20-24 years old and more educated that are White, Caucasian, Black, African American and Hispanic/Latino indicated the types of foods most often consumed, non-Organic Health Friendly cheese. (p=.016)

- **Cereal**: Undergraduates that are under twenty years old with high school and some college and White, Caucasian, Black, African American and Hispanic/Latino indicated the types of foods most often consumed, non-Organic Health Friendly cereal. (p=.008)

- **Eggs**: Graduates who are older more educated and White, Caucasian and Asian indicated the types of foods most often consumed, Organic Health Friendly eggs. (p=.029)

- **Additives**: Undergraduates under twenty years old and with high school and some college indicated the following lifestyle characteristics; I try to eat foods free of artificial additives sometimes. (p=.015)

- **Country of Origin**: Undergraduates with high school and some college and are White Caucasian indicated the product characteristic, country of origin as moderately important. (p=.008)

VI. CONCLUSION

To summarize, the study contained a large number of hypotheses in the hopes of getting a deeper understanding of demographic factors of Respondents as per profile chosen. Almost 100% of the sample knew about Organic Health Friendly products which is promising for marketers looking to capitalize on the Organic Health Friendly movement in the fresh and packaged goods areas. This study attempted to advance the
knowledge of Respondents as per profile chosen, and their choice for Organic Health Friendly products. A recommendation to future researchers would be to narrow the choices of Organic Health Friendly products. The findings showed a strong preference for milk, eggs, and fruit but lacked any significant findings for other product categories such as pasta/rice, snack foods and meat.

The recommendations for the study of Respondents as per profile chosen, and their choice for Organic Health Friendly products would include a number of suggestions. The study was based on a convenience sample in New England. A number of limitations also hindered the outcome of the survey including; too many single participants which did not allow for analysis on the demographic variable; marital status, too many participants live on campus which deter students from going to purchase groceries since they are able to eat all meals seven days a week live on campus which deter students from going to purchase groceries since they are able to eat all meals seven days a week on campus. The majority of the sample was women. One suggestion to overcome these limitations would be to include a bigger sample outside of New England to a national scale. In order to prove or disprove the gender hypothesis, more males were needed in the sample as well as a large population of international students and more ethnic groups.

Moreover, the data collection period would be during the school year when students are checking their email on a daily basis. One major issue is when students do not check their email on a regular basis, the emails are returned undeliverable due to the size allocation of each student’s email account. One of the keys to generating the successful sample size was offering an incentive to the bookstore on campus. Two gift cards in the amount of $25 were offered to two random survey participants. Therefore, it is recommended that more studies would be necessary to understand the impact of gender and Respondents as per profile chosen,’s choice for Organic Health Friendly products.

REFERENCES


[28] Community Farm Alliance. Bridging the Divide. Growing Self-Sufficiency in our Food


[31] California Center for Public Health Advocacy, PolicyLink, and the UCLA Center for Health Policy Research. Designed for Disease: The Link


[87] Crop Management 29 April 2013


[99] Ifad (2005), Organic Agriculture and Poverty Reduction in Asia: China and India Focus: Thematic Evaluation.


[101] IFOAM (2005a), The IFOAM Basic Standards for Organic Production and Processing. IFOAM, Bonn


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Incidence and Severity of Adverse Drug Reactions and Spontaneous Adverse Drug Reporting in Hospital Settings of Lahore

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Abstract- Objective: The aim of the study was to observe the incidence and severity of ADRs and spontaneous adverse drug reporting and role of pharmacist in ADR reporting in different hospital settings of Lahore.

Study Design: Descriptive / retrospective study.

Plan and duration of study: This study was conducted from the health care providers working in different hospital settings of Lahore from 10th July to 10th Sept, 2016.

Materials and methods: The data was collected through a preformed questionnaire about knowledge of incidence and severity of ADRs and second portion was about spontaneous adverse drug reporting. Data was entered, analyzed and presented in the form of graphs.

Results: 150 healthcare providers were included (50 clinicians, 50 pharmacists & 50 nurses), out of which 28% observed and reported the ADRs, 42% only observed but did not reported the ADRs while 30% neither observed nor reported the ADRs. From the observed and reported ADRs, 54% were mild, 22% were moderate while 24% of ADRs were of severe nature. Most of the observed ADRs were due to the antibiotics (vancomycin 22%, amoxicillin-clavulanic acid 13%, ciprofloxacin 12%, clarithromycin 10%, penicillin 7%, metronidazole 3%, cephrtriazone 3%). Other drugs include ibuprofen 8%, paracetamol 3%, heparin and aspirin 3%, dexamethasone 4% and sulphacetamide 2%. While 9% of the ADRs were due to unknown drugs. Gastrointestinal tract (GIT) and Skin were the most commonly involved systems in 26% of ADRs, followed by oral cavity (21%) and respiratory system (14%), in the heart and the CNS 3% ADRs were found while 7% ADRs were due to unknown symptoms.

Conclusion: Awareness about spontaneous ADR reporting is still poor amongst healthcare professionals in Lahore. The incidence and severity of ADRs are well documented. Antibiotics comprise the major drug family associated with ADRs so should be rationally prescribed. Geriatrics, pediatrics and females were most affected with ADRs. There is need for establishing ADR monitoring center at every multidisciplinary hospital.

Index Terms- Adverse drug reactions, Spontaneous adverse drug reporting, pharmacotherapy

I. INTRODUCTION

Adverse Drug Reactions (ADRs) are inevitable consequences of pharmacotherapy. It is well known that all drugs carry the potential to produce both desirable and undesirable effects. No drug is absolutely safe under all circumstances of use or in all patients and ADRs may occur even if a drug is correctly selected and dosed. The World Health Organization defines an adverse drug reaction (ADR) as “a response to a drug which is noxious and unintended, and which occurs at doses normally used in man for the prophylaxis, diagnosis, or therapy of disease, or for the modification of physiological function”. [1-2]

Several classification methods have been proposed to describe ADRs such as by their severity (mild, moderate or severe), by reaction time (acute or latent) and whether the reaction is localized or systemic. However, the pharmacological classification which classifies ADRs into types A-F is the most commonly used. Type A (Augmented), Type B (Bizarre), Type C (Chronic), Type D (Delayed), Type E (End of use) and Type F (Failure of therapy). Many adverse drug reactions represent an exaggeration of the drug's therapeutic effects (called type 1 or overdose reactions). These reactions are usually not serious but are relatively common. Some adverse drug reactions result from mechanisms that are not currently understood (called type 2 or idiosyncratic reactions). This type of adverse drug reaction is largely unpredictable. [3-4]

ADR in hospital patients are divided into two categories: those that cause admission to hospital and those that occur in hospital inpatients after admission. Hospital based ADR monitoring can provide valuable information on drug usage. ADR add an unnecessary cost to an already burdened health care system and are usually preventable. [5]

An ADR may result from both drug related and non-drug related factors. [6] The risk of ADRs is necessarily an inherent risk of all drug therapy and is modulated by several factors, including dose and frequency of administration, genotype and pharmacokinetic characteristics of special populations, such as pediatric and geriatric patients and those with hepatic or renal impairment. ADRs arising from inappropriate drug use can be due to inappropriate dosage or duration of treatment, drug interactions, off-label use or use in contraindicated circumstances all of which can occur in the general population or in a hospital setting. [7-9] Due to the high frequency and potentially serious consequences, ADRs may have a dramatic impact in clinical practice both from a clinical and economic perspective. ADRs may increase costs due to increased hospitalization, prolongation of hospital stay and additional clinical investigations in more serious cases. [10-13]

Adverse drug reactions (ADRs) are considered as one of the leading causes of death among hospitalized patients. Thus reporting of adverse drug reactions become an important

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II. MATERIALS AND METHODS

This retrospective study was conducted for the period of two months from July 10th to September 10th, 2016, to analyse the incidence and severity of ADRs and spontaneous ADR reporting. The data was collected from the health care providers of different hospital settings on a data collection form having the basic information about patient, adverse drug reaction and ADR reporting system. Patients of both sex and of any age who developed an ADR before or after hospitalization are included in this study while patients with intentional or accidental poisoning, patients who developed an ADR during transfusion of blood or blood products and vaccines, patients with drug abuse were excluded from the study. WHO definition of ADR was adopted. The data was collected from the 150 health care providers, out of which 50 were clinicians, 50 were pharmacists and 50 were nurses. Some of the health care providers observed and reported the ADRs while some only observed but not reported the ADRs while some neither observed nor reported the ADRs. For the reporting of ADRs they used either yellow card or the hospital’s own ADR reporting form. The information about awareness of ADRs and ADR reporting system and demographic details of the patient were collected along with the ADR and its management details in a systematically designed data collection form. All relevant including the drugs patient received prior to the onset of reaction, respective dose and route of administration with frequency and the patient’s allergic status were noted. Any drug treatment or supportive therapy given for management of the reactions was also noted.

The causality relationship between the ADR and the suspected drug therapy was assessed. The ADRs were classified. The severity of the ADRs were determined and classified as mild, moderate and severe. Mild reactions were defined as self-limiting and able to resolve over time without treatment and did not contribute to prolongation of length of stay. Moderate ADRs were defined as those that required therapeutic intervention and hospitalization prolonged by one day but resolved in less than 24 hours or change in drug therapy or specific treatment to prevent a further outcome. Severe ADRs were those that were life threatening, producing disability and those that prolonged hospital stay or led to hospitalization, required intensive medical care or led to the death of the patient.

The most common class of drugs causing ADRs were identified and documented. Patients outcome were reported as recovering, recovered and death.

III. RESULTS

The data was collected from the 150 health care providers (50 clinicians, 50 pharmacists and 50 nurses) out of which 42 observed and reported the ADRs, 62 only observed but not reported the ADRs while remaining 46 neither observed nor reported the ADRs. (Fig 1).

100% of the clinicians and pharmacists and 92% nurses were aware of ADRs while 8% of the nurses had little knowledge about ADRs. (Fig 2).

A total of 104 suspected adverse drug reactions were recorded out of which 40% were reported and 60% were not. Majority of the health care providers 76% used hospital’s own ADR reporting form while 24% used yellow card for reporting of ADRs which were then submitted to the ADR focal person in the hospital pharmacy. Out of 104 patients, 63% were female and 37% were male. Maximum patients (30%) belonged to the age group 41-60 years, followed by (25%) 21-40 years, (21%) 1 day-1 year, (14%) 41-60 year and (10%) belonged to >60 years. (Table 1).

Vancomycin caused highest 22% of the ADRs, Augmentin caused 13%, ciprofloxacin 12%, clarithromycin 10%, ibuprofen 8%, penicillin 7%, dexamethasone 4%, paracetamol, metronidazole, cephradine and heparin+aspirin caused 3%, sulphacetamide 2%, meronam+lenzolid 1% while 9% of the ADRs were due to the unknown drugs. (Table 2).

Gastrointestinal tract (GIT) and Skin were the most commonly involved systems in 26% of ADRs, followed by oral cavity (21%) and the heart and the CNS (8%) and in respiratory system 6% ADRs were found while the ADRs due to unknown causes involved 5%. (Fig 3).

Out of 104 ADRs, 71% were of type B while 29% were type A. (Table 3).

54% of the ADRs were mild, 22% were moderate and 24% were severe. (Fig 4).

The 63% patients were fully recovered, 31% of the cases were recovering while 6% were died before coming to hospital or during hospital stay. (Fig 5)
Figure 1: Spontaneous reporting of ADRs

Figure 2: Awareness about ADRs

Figure 3: Systems affected due to ADRs
Figure 4: Level of Severity

Figure 5: Outcome

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
<th>Total number of ADRs</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1day-1 year</td>
<td>11</td>
<td>11</td>
<td>22</td>
<td>21%</td>
</tr>
<tr>
<td>2-20 years</td>
<td>4</td>
<td>10</td>
<td>14</td>
<td>13%</td>
</tr>
<tr>
<td>21-40 years</td>
<td>6</td>
<td>20</td>
<td>26</td>
<td>25%</td>
</tr>
<tr>
<td>41-60 years</td>
<td>11</td>
<td>21</td>
<td>32</td>
<td>31%</td>
</tr>
<tr>
<td>&gt;60 years</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>66</td>
<td>104</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 1: Sex and age wise distribution of ADRs
<table>
<thead>
<tr>
<th>Name of Drug</th>
<th>Dosage form</th>
<th>No of ADRs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancomycin</td>
<td>Injection</td>
<td>23</td>
</tr>
<tr>
<td>Augmentin</td>
<td>Tablet/Injection</td>
<td>13</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>Injection</td>
<td>12</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>Syrup</td>
<td>12</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>Tablet/suspension</td>
<td>8</td>
</tr>
<tr>
<td>Penicillin</td>
<td>Injection</td>
<td>7</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>Injection</td>
<td>4</td>
</tr>
<tr>
<td>Cephtriaxone</td>
<td>Injection</td>
<td>3</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>Tablet/injection</td>
<td>3</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>Tablet</td>
<td>2</td>
</tr>
<tr>
<td>Sulphacetamide</td>
<td>Ointment</td>
<td>2</td>
</tr>
<tr>
<td>Heparin+Aspirin</td>
<td>Injection+tablet</td>
<td>2</td>
</tr>
<tr>
<td>Augmentin and ceftozidine</td>
<td>Tablet</td>
<td>1</td>
</tr>
<tr>
<td>Heparin</td>
<td>Injection</td>
<td>1</td>
</tr>
<tr>
<td>Paracetamol+Hydroxyzine</td>
<td>Tablet</td>
<td>1</td>
</tr>
<tr>
<td>Meropenam+Lenzolid</td>
<td>Tablet/injection</td>
<td>1</td>
</tr>
<tr>
<td>Unknown drug</td>
<td>-</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 2: Drugs causing ADRs

<table>
<thead>
<tr>
<th>Category</th>
<th>No. of ADRs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>30</td>
<td>29%</td>
</tr>
<tr>
<td>Type B</td>
<td>74</td>
<td>71%</td>
</tr>
<tr>
<td>Total</td>
<td>104</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3: Type of Reaction

IV. DISCUSSION

With the addition of a multitude of drugs to the physician’s armamentarium, the treatment of many hitherto uncontrollable diseases has become possible. However, every progress has a price to pay, so is the case with the new drugs which have led to the iatrogenic diseases. Although most patients derive far more benefit than harm, a proportion of them experience adverse drug reactions (ADRs) from the use of the medicines at recommended doses and frequencies. [20,21]

This study was mainly conducted in general medical, surgical and derma units of the 5 government and 1 private hospital of Lahore. The data was collected from 150 health care providers (50 clinicians, 50 pharmacists and 50 nurses). Out of these 28% health care providers observed and reported the ADRs, 42% were only observed but not reported while 30% were those who neither observed nor reported the ADRs. In comparison with other studies for search of ADRs this can be considered as underreporting. It is a universal problem and many reasons were identified such as busy schedule of clinicians, lack of knowledge about the exact authority to report ADRs to, unavailability of ADR reporting forms, lack of incentives, reporting process being tedious and inadequate expertise. Our verbal discussion with health care providers revealed similar reasons for underreporting in many institutions.
The details of our study showed female gender predominance over males. This might be due to higher emotion quotient in females, which makes them more sensitive to the pharmacological actions of medicines. Rational dose titration may lead to minimization of ADRs in females. The larger percentage of ADRs was reported from geriatric and pediatric populations. In our study pediatric (21%) and geriatric patients (35%) experienced a higher percentage of ADRs than the adult population. Incidence of ADRs was found to be higher in older patients and pediatric patients due decreased basal metabolic rate, hypersensitivity, allergies, genetic causes, concomitant disease conditions and multiple drug regimens.

The antibiotics were the class of drugs which caused most of the adverse drug reactions. Out of these antibiotics vancomycin caused highest of the ADRs. These adverse drug reactions mainly affecting the GIT and skin. Thus implementation of antibiotic guidelines for the hospital scenario and strict adherence should be ensured to promote the rational use. Analysis of the type of reported ADRs revealed Type B predominance. Type B reactions comprise approximately 71% of all ADRs and include hypersensitivity drug reactions. Even though, most of them were mild reactions, they resulted in an increased health care cost due to an increased length of stay and need of some medical interventions as a result of incidence of Adverse Drug Reactions.

Treatment of ADR was provided to 94% of the patients. Mostly ADRs were allergic/hypersensitivity reactions. However, some reactions involved additional, poorly understood mechanisms that are not easily classified. Identifiable risk factors for drug hypersensitivity reactions include age, female gender, concurrent illness and previous hypersensitivity to related drugs. Treatment was largely supportive and includes discontinuation of the offending medication, symptomatic treatment and patient education. Patients with penicillin allergy should avoid carbapenems and caution should be used in prescribing cephalosporins in these patients. In case of vancomycin sensitivity, amikacin was used instead of vancomycin or reaction may be treated by slow administration of vancomycin. Usually for the allergic symptoms like fever, itching and skin rash anti allergic medicines i.e. Avil injection (Pheniramine maleate) and SoluCortef (Hydrocortisone Sodium Succinate) and dexamethasone were used. Other includes prednisone, diphenhydramine and either epedrine or a histamine H2- receptor antagonist. Different medicines were also used according to the symptoms of the ADR e.g. for skin reactions derma drugs were used.

Most of the adverse drug reactions are preventable. This calls for the urgent need to reinforce the monitoring of adverse reactions to drugs, public education against self-medication, inclusion of reaction monitoring, and an introduction to drug-safety in the curriculum of medical undergraduates, as well as systemic and periodic medical education of health professionals. This multi-pronged strategy could lead to a reduction in the incidence and severity of adverse drug reactions to be assessed in Pakistan. [22-24]

V. CONCLUSION

Awareness about ADR reporting is still poor ,amongst healthcare professionals in Lahore. The incidence and severity of ADRs are well documented. The incidence is more in hospitalized patients compared to ADR induced hospital admission. Antibiotics comprise the major drug family associated with ADRs so should be rationally prescribed. Geriatrics, pediatrics and females were most affected with ADRs. Improved communication between the physicians, pharmacists and nurses with the pharmacovigilance center in the hospital can reduce incidence of ADRs and improve patient quality of life. There is need for establishing ADR monitoring center at every multidisciplinary hospital. Also, more original studies need to be conducted in Pakistani population to know the exact prevalence of ADRs in Pakistani hospitals.

REFERENCES


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EFFECT OF PROJECT IMPLEMENTATION ON PERFORMANCE OF TIGO RWANDA

A Case Study of Tigo Sales School Project

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ABSTRACT:
Implementation has been viewed as a tool for better productivity, general workforce skill development and motivation. Rwanda’s mobile telecommunication sector has seen the need to invest in training and supervision projects of their business agents. This study was set to examine the effect of project implementation on the performance of Tigo Rwanda. The specific objective of this study were; to determine the effect of project scheduling on the performance of Tigo in Rwanda, to examine the project resource mobilization on the performance of Tigo in Rwanda, and to establish the effect of project financial management on the performance of Tigo in Rwanda, and to establish the effect of project supervision on the performance of Tigo in Rwanda. Descriptive survey design was employed in this study. Stratified random sampling was employed in this study with target population being 1000 and a sample size of 286 respondents determined by Yaro Yamane Formula (1967). Data was collected using structured questionnaires and focus group interview guides whose reliability and validity were tested at Cronbach’s Alpha coefficient index of 0.70. A 5-point Likert Scale for multiple items on the questionnaire was used. Validation of the questionnaire was done by University Supervisors while content validation was done by a pilot survey. Data was analyzed by both multiple regression and content analysis. The finding was that there was statistically significant positive correlation effect of project implementation practices on the performance of Tigo Rwanda. The study concluded that enhancing management of project scheduling contributes more, followed by improving management of project supervision, project financial innovations and lastly improving management of project mobilization respectively in increasing the project profitability and market share in Tigo Rwanda. The study recommends that more attention be put on managing project implementation practices like scheduling with proper tools like CPM and PERT.

KEY WORDS: Project Implementation, performance, Profitability, market share

I. Introduction

This chapter presents the background to the study and builds a case for the research problem. It begins by reviewing the concepts of the effect of project implementation on the performance of Tigo Rwanda. This section also includes the background to the study, statement of the problem, objectives, hypotheses, justification, significance of the study, scope of the study, limitations of the study, assumptions of the study, operational definition of terms used in the study and the organization of the proposal.

II. Statement of the Problem

The influence of project implementation practices on organizational performance is one significant topic in the field of entrepreneurship and telecommunication industry development as evidenced by an increasing number of publications and studies on the topic (World Bank, 2013). According to Ahmad (2011), approximately 80% to 90% of business projects fail within 5-10 years.
According to the Economic Survey (2013), the performance of projects is weak as evidenced by the decline in growth rate from 5.4% in 2011 to a 4.3% in 2013. Such decline in performance may lead to unemployment in Rwanda which may also lead to social injustices and crime (RDB, 2013). Furthermore, the ways to address bimodal distribution of firms where 59% are MSEs, 16% medium firms, and 23% large firms is still an empirical matter (KPMG, 2012). Poor business performance in the telecommunication sector has for long remained unexplained most especially in the third-world countries perspective where the telecommunication is increasingly gaining importance (Brigham, 2002). However, studies from developed nations find inefficient project implementation practices to contribute immensely to MSEs poor business performance.

There is a challenge in Rwanda telecommunication related to the lack of technical capacity to effectively manage projects. It is therefore critical to increase the technical know-how in the country to maintain and manage voice, text and data technologies. One way of addressing the current shortage is for telecom operators to work closely with training providers in order to develop hands-on technical training projects. These could be targeted at young graduates, especially in areas related to telecommunications and engineering (RURA Annual Report 2008). Due to fast pace global and technological development, firms are now facing new changes and technological advancements have to be shaped to address the capabilities and competencies required to perform a particular tasks.

Thus, to cope with these challenges, more improved and effective training projects like, Tigo Sales Training School Project, are required by all corporate organizations. Effective training projects help in constructing a more conducive learning environment for the workforce and train them to cope with the upcoming challenges more easily and in time (Wei-Tai, 2006).

In spite of the large number of researches on the relationship between project implementation and organizational performance, there appears to be a gap between project implementation strategies and performance in the telecommunication industry. This study thus seeks to close this gap by deeply investigating this phenomenon through the relevant literature, to establish the relationship between project implementation practices and performance thus providing suggestions to the industry by examining the effect of implementation of Tigo Sales School Project on the Performance of Tigo Rwanda.

III. Research Objective

3.1 General objectives

To establish the effect of Project Implementation on the Performance of Tigo Rwanda

3.2 Specific objectives

I. To determine the effect of project scheduling on the performance of Tigo Rwanda
II. To examine the project resource mobilization on the performance of Tigo Rwanda
III. To measure the effect of project financial management on the performance of Tigo Rwanda
IV. To establish the effect of project supervision on the performance of Tigo Rwanda

IV. Research questions

I. What is the effect of project scheduling on the performance of Tigo Rwanda?
II. What is the impact of project resource mobilization on the performance of Tigo Rwanda?
III. What is the effect of project financial management on the performance of Tigo Rwanda?
IV. What is the effect of project supervision on the performance of Tigo Rwanda?

V. Research Design

Descriptive survey research design was used to collect data from respondents. Descriptive research is designed to clearly describe a situation or behavior at a particular time (Diem, 2002). A descriptive research would give a thorough and accurate description survey by determining the how or why the phenomena came into being and also what was involved in the situation (Robson, 2002). According to Mugenda and Mugenda (1999), a survey design attempts to collect data from members of a population to determine the current status of that population with respect to one or more variables.

VI. Target Population

The unit of analysis of the study was the Tigo Rwanda with a population of 1000 employees. This comprised of senior managers, middle level managers and operations staff (clerks, customer care representatives, human resource officers, graduate clerks, computer...
operators, secretaries, security officers, accountants, marketers, auditors and messengers) of Tigo Rwanda. The target population constituted 20 senior managers, 180 middle managers and 800 operations staff.

VII. Sample Design

7.2 Sampling technique
Stratified purposive sampling was employed since the target population was less than 100. In this study the whole population was 90 which was less than 100 so the study employed Stratified purposive sampling in which the whole population of 90 was taken as respondents.

VIII. Data Collection

8.1 Data collection Procedure
Data was collected from employees of Tigo Rwanda using self-administered questionnaires. Interviews were conducted on managers from whom the researcher would gather more perspectives. Transmittal letter was issued from the department to enable the researcher proceed to the field.

8.2 Data analysis
Statistical Package for Social Sciences (SPSS version 23) was used to analyse the data because it was able to handle large amounts of data. Descriptive and inferential statistics were used. Descriptive statistics such as frequencies, percentages, bar graphs and pie charts were used to present data besides narratives, explanations and discussions. Regression analysis was also used. Interpretation of the data was then be done and conclusion drawn.

The following general regression model was adopted:

\[ P_i = \alpha + \beta_i \sum X_i + \varepsilon_i \] ........................... Eq. 3.1

Where; \( P \) is Performance of the \( i^{th} \) Tigo Agents, \( \alpha \) is Model Intercept, \( \beta_i \) (\( i=1 \ldots 4 \)) are the slopes of Model and \( \varepsilon \) is Random Error assumed as Normally Distributed, independent and identically distributed, \( \varepsilon \sim N (0, \sigma^2) \).

In the context of the current work, Eq. 3.1 can also be as follows:

\[ P = \alpha + \beta_1 PSchd + \beta_2 PMob + \beta_3 PFm + \beta_4 PSup + \varepsilon \] .......................... Eq. 3.2

where; the variable \( \beta_1 PSchd \) is Effect of Project Scheduling on Tigo Performance, \( \beta_2 PMob \) is the Effect of Project Mobilization on Tigo Performance, \( \beta_3 PFm \) is the Effect of Project Financial Management on Tigo Performance and \( \beta_4 PSup \) is the Effect of Project Supervision on Tigo Performance.

IX. Research and discussion

Table 4.1: Response Rate of the Study
The response rate of the study is indicated in Table 4.1 below.

<table>
<thead>
<tr>
<th>Results</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents</td>
<td>276</td>
<td>97</td>
</tr>
<tr>
<td>Non Respondents</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>286</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The questionnaires were distributed to 286 randomly selected respondents. From the 286 questionnaires, 276 were filled and returned, giving 96.5 % response rate. This was comparable with the study by Goldstein (2006) in which 100 respondents were sent questionnaires and the response was 92 which translated to 92% response rate. The collection procedures used involved personal administration of the questionnaires then followed up through mobile phone calls for confirmation date when they would be ready for collection. The response rate found was adequate for analysis and discussions of the study findings especially when compared to other results in the communication industry by Goldstein (2006) – 92%, Ward and Chapman (2003) – 89% and Afuah, (2003), –87%. The
3.0% unreturned questionnaires could be attributed to delay on the part of the respondent in completing the filling of the questionnaires thereby not being able to return by the collection date.

4.2 Background of Respondents

The demographic characteristics of the respondents were analyzed in terms of gender, highest educational level and age as shown below.

4.2.1 Gender Profile of Respondents

The respondents indicated their gender profile in terms of either male or female in order to determine the nature of gender relations in the construction industry. Table 4.2 illustrates gender profile of the sample.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>89</td>
<td>28.62</td>
</tr>
<tr>
<td>Female</td>
<td>197</td>
<td>71.34</td>
</tr>
<tr>
<td>Total</td>
<td>276</td>
<td>100</td>
</tr>
</tbody>
</table>

The study found that 71% of the respondents were females and 29% were males. The results indicate the communication industry is dominated by the females who account for the majority of the respondents. The study results compare well and are consistent with the study by Research and Markets, (2013) in which 67% of the respondents were of the female gender confirming that the industry is female dominated.

4.2.2 Age of respondents

The respondents stated their age brackets as requested in the questionnaire and the results were as shown in table 4.3 below.

<table>
<thead>
<tr>
<th>Ages</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30 yrs</td>
<td>75</td>
<td>27.17</td>
</tr>
<tr>
<td>31-40 yrs</td>
<td>136</td>
<td>49.27</td>
</tr>
<tr>
<td>41-50 yrs</td>
<td>39</td>
<td>14.13</td>
</tr>
<tr>
<td>51 &amp; Above yrs</td>
<td>26</td>
<td>09.42</td>
</tr>
<tr>
<td>Total</td>
<td>276</td>
<td>100</td>
</tr>
</tbody>
</table>

Majority of the respondents 49% were aged 31 to 40 years. This was followed by 27% of the respondents being between 21 to 30 years. There were 14% of the respondents between the ages of 41 to 50 years. Those in age bracket of 51 years and above were only 9%. A cumulative 76% of the respondents are within 21 – 40 years. This implies that in the telecommunications industry, most of the people working or doing business are mainly the youth below 40 years. This is probably due to the level of technology involved which puts many people above 40 struggling to understand.

4.2.3 Highest Education Level

The respondents were requested to give their highest educational level. Table 4.4 illustrates the levels of qualification for the entire sample.

<table>
<thead>
<tr>
<th>Education level</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma</td>
<td>128</td>
<td>46.37</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>101</td>
<td>36.59</td>
</tr>
<tr>
<td>Post-Graduate</td>
<td>47</td>
<td>17.03</td>
</tr>
<tr>
<td>Total</td>
<td>276</td>
<td>100</td>
</tr>
</tbody>
</table>

Slightly less than half (46%) of the respondents were diploma holders with 37% being undergraduate holders. Only 17% of the respondents had post-graduate degree qualifications. This shows that the respondents are capable and reliable to explore the underpinning issues related to the study. However, the number of respondents with diploma was high probably due to the age group of majority involved which could still be in colleges and universities pursuing their further studies.
4.2.4 Experience Levels

The respondents stated their age brackets as requested in the questionnaire and the results were shown in table 4.5 below.

Table 4.5: Experience Levels

<table>
<thead>
<tr>
<th>Ages</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 yrs</td>
<td>151</td>
<td>54.71</td>
</tr>
<tr>
<td>4-5 yrs</td>
<td>96</td>
<td>34.78</td>
</tr>
<tr>
<td>6-9 yrs</td>
<td>19</td>
<td>06.88</td>
</tr>
<tr>
<td>10 &amp; Above yrs</td>
<td>10</td>
<td>03.62</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>276</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Majority (55%) of the respondents were having an experience level of between 1-3 years followed closely with 35% having experience level of between 4-5 years. 7% of the respondents had 6-9 years experience while only 4% of the respondents had experience level of 10 years and above. This implies that most of the people in the telecommunications industry just joined the industry. This could be attributed to the fact that they could have just left colleges or universities and being technology savvy, they fit best in the telecommunications sector which requires a very vibrant group of staff in terms of learning and innovations.

4.3 Presentation of Descriptive Statistics According to Research Questions

Descriptive analysis was done on the responses obtained from the questionnaire to investigate how the respondents rated the effect of project scheduling practices, project mobilization practices, project financial innovation practices and project supervision practices on the performance of projects in Rwanda. The results were summarized in table 4.6 and table 4.7.

Table 4.6 Descriptive Statistics for Project Implementation Practices and Project Profitability

<table>
<thead>
<tr>
<th>Project Implementation Practices</th>
<th>N</th>
<th>Project Profitability</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Frequency</td>
<td>Percent</td>
<td></td>
</tr>
<tr>
<td>Our profit levels have consistently increased since we always engage our stakeholders in time to determine the likely project activity duration</td>
<td>276</td>
<td>218</td>
<td>79</td>
<td>2.232</td>
</tr>
<tr>
<td>The way we have been sequencing the project activities according to the order in which they should be carried out has always improved our profits</td>
<td>276</td>
<td>195</td>
<td>71</td>
<td>1.446</td>
</tr>
<tr>
<td>All resources used in the project are always planned for in advance thus the increasing trend of our profits</td>
<td>276</td>
<td>213</td>
<td>77</td>
<td>2.146</td>
</tr>
<tr>
<td>Our large network of partners have helped us to realize more profits</td>
<td>276</td>
<td>215</td>
<td>78</td>
<td>1.884</td>
</tr>
<tr>
<td>Our collaborative approach with our partners in the provision of our services has helped increase our profitability</td>
<td>276</td>
<td>218</td>
<td>79</td>
<td>2.324</td>
</tr>
<tr>
<td>Our projects good financial innovations have helped to manage our diverse finance portfolio effectively so is our profitability</td>
<td>276</td>
<td>232</td>
<td>84</td>
<td>1.628</td>
</tr>
<tr>
<td>The high level of accountability in our project has been the source of our profitability</td>
<td>276</td>
<td>246</td>
<td>89</td>
<td>2.137</td>
</tr>
</tbody>
</table>
Our budgets are always put in place well in advance. This help manage project funds well hence our profitability | 276 | 199 | 72 | 1.211 | 0.384
---
Our internal and external supervision to our operations as well as the use of team supervision from our various operational teams has been a good driver to our sales hence profit growth | 276 | 185 | 67 | 1.245 | 0.246

**Source: Survey Data (2016)**

The results in Table 4.6 show that 79% (Mean 2.232; SD=0.135) of the respondents believe that project profit levels have consistently increased since they always engage stakeholders in time to determine the likely project activity duration and in effect improve project performance in terms of project profitability. However, the standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with it. 71% (Mean 1.446; SD=0.324) of the respondents agreed that sequencing of the project activities according to the order in which they should be carried out has always improved their project profitability. However, the standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with it. The results further indicate that 78% (Mean 2.146; SD=0.245) of the respondents agreed that project resources are always planned for in advance thus the increasing trend of their project profitability. However, the standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with it. 79% (Mean 2.324; SD=0.324) of the respondents agreed that collaborative approach with our partners in the provision of our services has helped increase the project profitability. The standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with this fact. 84% (Mean 1.628; SD=0.301) of the respondents agreed that good financial innovations have helped to manage their diverse finance portfolio effectively so is project profitability. The standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with this fact. 72% (Mean 1.211; SD=0.384) of the respondents agreed that budgets are always put in place well in advance and that this helped manage project funds well hence improved market share. 67% (Mean 1.245; SD=0.246) of the respondents agreed that internal and external supervision to their operations as well as the use of team supervision from various operational teams has been a good driver to their sales hence project profitability growth. The standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with this fact.
Table 4.7 Descriptive Statistics for Project Implementation Practices and Project Market Share

<table>
<thead>
<tr>
<th>Project Implementation Practices</th>
<th>N</th>
<th>Project Profitability Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Our profit levels have consistently increased since we always engage our stakeholders in time to determine the likely project activity duration</td>
<td>276</td>
<td>213</td>
<td>77</td>
</tr>
<tr>
<td>The way we have been sequencing the project activities according to the order in which they should be carried out has always improved our market share</td>
<td>276</td>
<td>207</td>
<td>75</td>
</tr>
<tr>
<td>All resources used in the project are always planned for in advance thus the increasing trend of our market share</td>
<td>276</td>
<td>215</td>
<td>78</td>
</tr>
<tr>
<td>Our large network of partners have helped us to realize more market share</td>
<td>276</td>
<td>199</td>
<td>72</td>
</tr>
<tr>
<td>Our collaborative approach with our partners in the provision of our services has helped increase our market share</td>
<td>276</td>
<td>210</td>
<td>76</td>
</tr>
<tr>
<td>Our projects good financial innovations have helped to manage our diverse finance portfolio effectively so is our market share</td>
<td>276</td>
<td>177</td>
<td>64</td>
</tr>
<tr>
<td>The high level of accountability in our project has been the source of our market share</td>
<td>276</td>
<td>229</td>
<td>83</td>
</tr>
<tr>
<td>Our budgets are always put in place well in advance. This help mange project funds well hence our market share</td>
<td>276</td>
<td>204</td>
<td>74</td>
</tr>
<tr>
<td>Our internal and external supervision to our operations as well as the use of team supervision from our various operational teams has been a good driver to our sales hence market share growth</td>
<td>276</td>
<td>213</td>
<td>77</td>
</tr>
</tbody>
</table>

Source: Survey Data (2016)

The results in Table 4.7 show that 77% (Mean 1.175: SD=.233) of the respondents believe that project profit levels have consistently increased since they always engage stakeholders in time to determine the likely project activity duration and in effect improve project performance in terms of market share. However, the standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with it. 75% (Mean 1.546: SD=.395) of the respondents agreed that sequencing of the project activities according to the order in which they should be carried out has always improved their project market share. However, the standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with it. The results further indicate that 78% (Mean 2.322: SD=.626) of the respondents agreed that project resources are always planned for in advance thus the increasing trend of their project market share. However, the standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with it. 72% (Mean 1.483: SD=.757) of the respondents agreed that large network of partners have helped the project to realize more market share. However, the standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with it. 76% (Mean 2.138: SD=.336) of the respondents agreed that collaborative approach with our partners in the provision
of our services has helped increase the project market share. The standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with this fact. 64% (Mean 1.527; SD=.353) of the respondents agreed that good financial innovations have helped to manage their diverse finance portfolio effectively so is project market share. The standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with this fact. 83% (Mean 2.139; SD=.215) of the respondents agreed that high level of accountability in our project has been the source of improved market share. The standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with this fact. 74% (Mean 1.212; SD=.283) of the respondents agreed that budgets are always put in place well in advance and that this helped mange project funds well hence improved market share. 77% (Mean 1.123; SD=.237) of the respondents agreed that internal and external supervision to their operations as well as the use of team supervision from various operational teams has been a good driver to their sales hence market share growth. The standard deviation so realized indicate that not all the respondents agreed with this fact, some disagreed with this fact.

4.4.1 Effect of Project Implementation Practices and Project Profitability

4.4.1.1 Effect of Project Scheduling Practices and Project Profitability

Table 4.7: Correlation Coefficients & Regression Analysis of Project Scheduling Practices and Project Profitability

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Stand. Coef.</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Std. Er.</td>
<td>Beta</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I(Constant)</td>
<td>1.291</td>
<td>1.113</td>
<td>1.021</td>
<td>.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Scheduling</td>
<td>.783</td>
<td>.072</td>
<td>.778</td>
<td>4.162</td>
<td>.000</td>
<td>.735</td>
<td>1.360</td>
</tr>
<tr>
<td>R-squared</td>
<td>.0613</td>
<td>Mean dependent variable</td>
<td>1.804</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>.609</td>
<td>S.D. dependent var</td>
<td>0.472</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>7.236</td>
<td>Durbin-Watson statistic</td>
<td>1.766</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob(F-statistics)</td>
<td>.032</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical significant effect of project scheduling on the performance (profitability) Tigo Rwanda. From table 4.6, $R^2$ is the models goodness of fit for the regression line which was obtained using the correlation coefficient. In this case $R^2$ was 0.613. This means that 61.3% of variation in the dependent variable-project profitability can be explained by the variance in independent variable-project scheduling with only 38.7% of the variation in dependent variable being explained by the error-term or other variables other than project scheduling. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to understand this relationship was: $P = 1.291 + 0.783X_1 + \varepsilon$

The results in the coefficient table 4.6 thus show that there was a significant effect of project scheduling on the performance (profitability) of Tigo Rwanda since $p=0.000$ which is less than $p<0.05$ at a 95% confidence interval. There was also a positive unstandardized beta coefficient of 0.783 as indicated by the coefficient to the project scheduling. The computed F statistic (10, 276) = 7.236 and the p-value for the overall regression relationship was ($p = 0.000$), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project scheduling on the performance (profitability) of Tigo Rwanda ($F=7.236$, $R^2 = 0.613$, $\text{Sig}=0.000$ at $\alpha=0.05$). The probability of the t statistic (4.162) for the b coefficient is $p<0.001$ which is less than the level of significance of 0.05.

The regression model further demonstrates that a one unit change in the project profitability is attributed to an increase of 0.783 in the project scheduling in Tigo Rwanda. The Tolerance (0.735) and Variance Inflation Factor (VIF) (1.360) indicate there was no problem of multi-collinearity (there was no overlap between the predictors) since VIF was less than 5 and the tolerance was above 0.20. This indicates that the predictor variables were appropriate for this study and were also objective for the purpose of this study.
### 4.4.1.2 Effect of Project Mobilization Practices and Project Profitability

Table 4.8: Correlation Coefficients & Regression Analysis of Project Mobilization Practices and Project Profitability

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standard. Coef.</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Mobilization</td>
<td>2.051</td>
<td>1.113</td>
<td>1.843</td>
<td>.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.643</td>
<td>.112</td>
<td>.632</td>
<td>3.385</td>
<td>.011</td>
<td>0.694</td>
<td>1.440</td>
</tr>
</tbody>
</table>

R-squared 0.413 Mean dependent variable

Adjusted R-squared 0.409 S.D. dependent var 0.243

F-statistics 9.654 Durbin-Watson statistic

Prob(F-statistics) 0.002

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical significant effect of project mobilization on the performance (profitability) Tigo Rwanda. From table 4.7, $R^2$ is the models goodness of fit for the regression line which was obtained using the correlation coefficient. In this case $R^2$ was 0.413. This means that 41.3% of variation in the dependent variable-project profitability can be explained by the variance in independent variable-project mobilization with only 58.7% of the variation in dependent variable being explained by the error-term and other variables other than project mobilization. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to understand this relationship was: $P = 2.051 + 0.643X + \epsilon$

The results in the coefficient table 4.7 thus show that there was a significant effect of project mobilization on the performance (profitability) of Tigo Rwanda since $p<0.011$ which is less than $p<0.05$ at a 95% confidence interval. There was also a positive unstandardized beta coefficient of 0.643 as indicated by the coefficient to the project mobilization. The computed F statistic (10, 276) = 9.654 and the p-value for the overall regression relationship was ($p = 0.000$), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project mobilization on the performance (profitability) of Tigo Rwanda ($F=9.654$, $R^2 = 0.413$, Sig=0.011 at $\alpha=0.05$).

The probability of the t statistic (3.385) for the b coefficient is $p<0.001$ which is less than the level of significance of 0.05. The regression model further demonstrates that a one unit change in the project profitability is attributed to an increase of 0.783 in the project mobilization in Tigo Rwanda. The Tolerance (0.694) and Variance Inflation Factor (VIF) (1.440) indicate there was no problem of multi-collinearity (there was no overlap between the predictors) since VIF was less than 5 and the tolerance was above 0.20. This indicates that the predictor variables were appropriate for this study and were also objective for the purpose of this study.

### 4.4.1.3 Effect of Project Financial Innovation Practices and Project Profitability

Table 4.9: Correlation Coefficients & Regression Analysis of Project Financial Innovation Practices and Project Profitability

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standard. Coef.</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Financial Innovations</td>
<td>1.149</td>
<td>1.543</td>
<td>2.437</td>
<td>.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.767</td>
<td>.008</td>
<td>.758</td>
<td>2.642</td>
<td>.003</td>
<td>0.996</td>
<td>1.004</td>
</tr>
</tbody>
</table>

R-squared 0.588 Mean dependent variable

Adjusted R-squared 0.585 S.D. dependent var 0.472

F-statistics 8.429 Durbin-Watson statistic

Prob(F-statistics) 0.046

Source: Survey Data (2016)
Regression analysis was conducted to investigate the statistical significant effect of project financial innovations on the performance (profitability) of Tigo Rwanda. From table 4.8, R² is the models goodness of fit for the regression line which was obtained using the correlation coefficient. In this case R² was 0.588. This means that 58.8% of variation in the dependent variable-project profitability can be explained by the variance in independent variable-project financial innovations with only 41.2% of the variation in dependent variable being explained by the error-term or other variables other than project financial innovation. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to understand this relationship was: 

\[ P = 1.49 + 0.767X_3 + \varepsilon \]

The results in the coefficient table 4.8 thus show that there was a significant effect of project financial innovations on the performance (profitability) of Tigo Rwanda since \( p=0.003 \) which is less than \( p<0.05 \) at a 95% confidence interval. There was also a positive unstandardized beta coefficient of 0.783 as indicated by the coefficient to the project financial innovations. The computed F statistic (10, 276) = 8.429 and the p-value for the overall regression relationship was (\( p = 0.003 \)), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project financial innovations on the performance (profitability) of Tigo Rwanda (F=8.429, R² = 0.588, Sig=0.003 at \( \alpha=0.05 \)). The probability of the t statistic (2.642) for the b coefficient is less than the level of significance at 0.05.

The regression model further demonstrates that a one unit change in the project profitability is attributed to an increase of 0.767 in the project financial innovations in Tigo Rwanda. The Tolerance (0.996) and Variance Inflation Factor (VIF) (1.004) indicate there was no problem of multi-collinearity (there was no overlap between the predictors) since VIF was less than 5 and the tolerance was above 0.20. This indicates that the predictor variables were appropriate for this study and were also objective for the purpose of this study.

### Effect of Project Supervision Practices and Project Profitability

Table 4.10: Correlation Coefficients & Regression Analysis of Project Supervision Practices and Project Profitability

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Stand. Coef.</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Supervision</td>
<td>1.761</td>
<td>.716</td>
<td>2.879</td>
<td>.000</td>
<td></td>
<td></td>
<td>1.375</td>
</tr>
<tr>
<td>R-squared</td>
<td></td>
<td>.513</td>
<td>Mean dependent variable</td>
<td>1.912</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td></td>
<td>.505</td>
<td>S.D. dependent var</td>
<td>0.758</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>8.837</td>
<td>1.864</td>
<td>Durbin-Watson statistic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob(F-statistics)</td>
<td>0.017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical significant effect of project supervision on the performance (profitability) of Tigo Rwanda. From table 4.9, R² is the models goodness of fit for the regression line which was obtained using the correlation coefficient. In this case R² was 0.513. This means that 51.3% of variation in the dependent variable-project profitability can be explained by the variance in independent variable-project supervision with only 48.7% of the variation in dependent variable being explained by the error-term or other variables other than project supervision. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to understand this relationship was: 

\[ P = 1.291 + 0.783X_3 + \varepsilon \]

The results in the coefficient table 4.9 thus show that there was a significant effect of project supervision on the performance (profitability) of Tigo Rwanda since \( p=0.000 \) which is less than \( p<0.05 \) at a 95% confidence interval. There was also a positive unstandardized beta coefficient of 0.716 as indicated by the coefficient to the project supervision. The computed F statistic (10, 276) = 8.837 and the p-value for the overall regression relationship was (\( p = 0.000 \)), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project supervision on the performance (profitability) of Tigo Rwanda (F=8.837, R² = 0.513, Sig=0.000 at \( \alpha=0.05 \)). The probability of the t statistic (2.162) for the b coefficient is \( p<0.001 \) which is less than the level of significance of 0.05.

The regression model further demonstrates that a one unit change in the project profitability is attributed to an increase of 0.783 in the project scheduling in Tigo Rwanda. The Tolerance (0.727) and Variance Inflation Factor (VIF) (1.375) indicate there was no problem of multi-collinearity (there was no overlap between the predictors) since VIF was less than 5 and the tolerance was above 0.20. This indicates that the predictor variables were appropriate for this study and were also objective for the purpose of this study.
4.4.1.5 Effect of Project Scheduling Practices and Project Market Share

Table 4.11: Correlation Coefficients & Regression Analysis of Project Scheduling Practices and Market Share

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Stand. Coef.</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Er.</td>
<td>Beta</td>
<td></td>
<td>Tolerance</td>
</tr>
<tr>
<td>(Constant)</td>
<td>2.328</td>
<td>1.678</td>
<td>1.437</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Project Scheduling</td>
<td>.787</td>
<td>.004</td>
<td>.783</td>
<td>3.436</td>
<td>.000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.622</td>
<td>Mean dependent variable</td>
<td>1.605</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.613</td>
<td>S.D. dependent variable</td>
<td>0.472</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>9.484</td>
<td>Durbin-Watson statistic</td>
<td>1.546</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob(F-statistics)</td>
<td>0.029</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical significant effect of project scheduling on the performance (market share) Tigo Rwanda. From Table 4.10, R² is the model's goodness of fit for the regression line which was obtained using the correlation coefficient. In this case R² was 0.622. This means that 62.2% of variation in the dependent variable-project market share can be explained by the variance in independent variable-project scheduling with only 38.8% of the variation in dependent variable being explained by the error-term or other variables other than project scheduling. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to understand this relationship was: \( P = 2.328 + 0.787X_1 + \varepsilon \)

The results in the coefficient table 4.10 thus show that there was a significant effect of project scheduling on the performance (market share) of Tigo Rwanda since \( p = 0.000 \) which is less than \( p < 0.05 \) at a 95% confidence interval. There was also a positive unstandardized beta coefficient of 0.787 as indicated by the coefficient to the project scheduling. The computed F statistic (10, 276) = 9.484 and the p-value for the overall regression relationship was \( p = 0.000 \), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project scheduling on the performance (market share) of Tigo Rwanda \( (F = 9.484, R^2 = 0.622, \text{Sig} = 0.000 \text{ at } \alpha = 0.05) \).

The probability of the t statistic (3.436) for the b coefficient is \( p < 0.001 \) which is less than the level of significance of 0.05. The regression model further demonstrates that a one unit change in the project market share is attributed to an increase of 0.787 in the project scheduling in Tigo Rwanda. The Tolerance (0.640) and Variance Inflation Factor (VIF) (1.565) indicate there was no problem of multi-collinearity (there was no overlap between the predictors) since VIF was less than 5 and the tolerance was above 0.20. This indicates that the predictor variables were appropriate for this study and were also objective for the purpose of this study.

4.4.1.6 Effect of Project Mobilization Practices and Project Market Share

Table 4.12: Correlation Coefficients & Regression Analysis of Project Mobilization Practices and Market Share

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Stand. Coef.</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Er.</td>
<td>Beta</td>
<td></td>
<td>Tolerance</td>
</tr>
<tr>
<td>(Constant)</td>
<td>1.041</td>
<td>1.146</td>
<td>1.743</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Project Mobilization</td>
<td>.733</td>
<td>.002</td>
<td>.730</td>
<td>1.194</td>
<td>.000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.538</td>
<td>Mean dependent variable</td>
<td>1.6 34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.533</td>
<td>S.D. dependent variable</td>
<td>0.472</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>9.433</td>
<td>Durbin-Watson statistic</td>
<td>1.615</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob(F-statistics)</td>
<td>0.003</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical significant effect of project mobilization on the performance (market share) of Tigo Rwanda. The identified model equation to understand this relationship was: \( P = 2.328 + 0.787X_1 + \varepsilon \)}
share) of Tigo Rwanda. From table 4.11, R² is the models goodness of fit for the regression line which was obtained using the correlation coefficient. In this case R² was 0.538. This means that 53.8% of variation in the dependent variable-project market share can be explained by the variance in independent variable-project scheduling with only 46.2% of the variation in dependent variable being explained by the error-term or other variables other than project mobilization. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to understand this relationship was: \[ P = 1.291 + 0.783X + \epsilon \]

The results in the coefficient table 4.6 thus show that there was a significant effect of project financial innovations on the performance (market share) of Tigo Rwanda since \( p=0.000 \) which is less than \( p<0.05 \) at a 95% confidence interval.

There was also a positive unstandardized beta coefficient of 0.733 as indicated by the coefficient to the project scheduling. The computed F statistic \((10, 276) = 9.433\) and the p-value for the overall regression relationship was \( p = 0.000 \), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project scheduling on the performance (market share) of Tigo Rwanda \((F=9.433, R^2 = 0.733, \text{Sig}=0.000 \text{ at } \alpha=0.05)\). The probability of the t statistic \((1.194)\) for the b coefficient is \( p<0.001 \) which is less than the level of significance of 0.05.

The regression model further demonstrates that a one unit change in the project market share is attributed to an increase of 0.733 in the project mobilization in Tigo Rwanda. The Tolerance (0.642) and Variance Inflation Factor (VIF) (1.556) indicate there was no problem of multi-collinearity (there was no overlap between the predictors) since VIF was less than 5 and the tolerance was above 0.20. This indicates that the predictor variables were appropriate for this study and were also objective for the purpose of this study.

### 4.4.1.7 Effect of Project Financial Innovation Practices and Project Market Share

<table>
<thead>
<tr>
<th>Table 4.13: Correlation Coefficients &amp; Regression Analysis of Project Financial Innovation Practices and Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
</tr>
<tr>
<td>Project Financial Innovation</td>
</tr>
<tr>
<td>R-squared</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
</tr>
<tr>
<td>F-statistics</td>
</tr>
</tbody>
</table>

**Dependent Variable: Market Share**

**Source: Survey Data (2016)**

Regression analysis was conducted to investigate the statistical significant effect of project financial innovations on the performance (market share) of Tigo Rwanda. From table 4.6, R² is the models goodness of fit for the regression line which was obtained using the correlation coefficient. In this case R² was 0.615. This means that 61.5% of variation in the dependent variable-project market share can be explained by the variance in independent variable-project financial innovations with only 38.5% of the variation in dependent variable being explained by the error-term and other variables other than project financial innovations. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to understand this relationship was: \[ P = 1.759 + 0.784X + \epsilon \]

The results in the coefficient table 4.6 thus show that there was a significant effect of project financial innovations on the performance (market share) of Tigo Rwanda since \( p=0.000 \) which is less than \( p<0.05 \) at a 95% confidence interval. There was also a positive unstandardized beta coefficient of 0.784 as indicated by the coefficient to the financial innovations. The computed F statistic \((10, 276) = 7.296\) and the p-value for the overall regression relationship was \( p = 0.000 \), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project financial innovations on the performance (market share) of Tigo Rwanda \((F=7.296, R^2 = 0.615, \text{Sig}=0.000 \text{ at } \alpha=0.05)\). The probability of the t statistic \((2.162)\) for the b coefficient is \( p<0.001 \) which is less than the level of significance of 0.05.

The regression model further demonstrates that a one unit change in the project market share is attributed to an increase of 0.784 in the project financial innovations in Tigo Rwanda. The Tolerance (0.913) and Variance Inflation Factor (VIF) (1.095) indicate there was no problem of multi-collinearity (there was no overlap between the predictors) since VIF was less than 5 and the tolerance was...
above 0.20. This indicates that the predictor variables were appropriate for this study and were also objective for the purpose of this study.

### 4.4.1.8 Effect of Project Supervision Practices and Project Market Share

#### Table 4.14: Correlation Coefficients of Project Supervision Practices and Market Share

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Stand. Coef.</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>I(Constant)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Supervision</td>
<td>2.245</td>
<td>1.012</td>
<td>1.437</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Project Supervision</td>
<td>.747</td>
<td>.018</td>
<td>.729</td>
<td>2.725</td>
<td>.003 .529 1.889</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.558</td>
<td>Mean dependent variable</td>
<td>1.895</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.534</td>
<td>S.D. dependent var</td>
<td>0.523</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>8.855</td>
<td>Durbin-Watson statistic</td>
<td>1.597</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob(F-statistics)</td>
<td>0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Dependent Variable: Market Share**

**Source: Survey Data (2016)**

Regression analysis was conducted to investigate the statistical significant effect of project supervision on the performance (market share) Tigo Rwanda. From table 4.13, $R^2$ is the models goodness of fit for the regression line which was obtained using the correlation coefficient. In this case $R^2$ was 0.558. This means that 55.8% of variation in the dependent variable-project market share can be explained by the variance in independent variable-project scheduling with only 44.2% of the variation in dependent variable being explained by the error-term or other variables other than project supervision. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to understand this relationship was: $P = 2.245 + 0.747X_d + \epsilon$

The results in the coefficient table 4.13 thus show that there was a significant effect of project supervision on the performance (market share) of Tigo Rwanda since $p<0.003$ which is less than $p<0.05$ at a 95% confidence interval. There was also a positive unstandardized beta coefficient of 0.783 as indicated by the coefficient to the project supervision. The computed $F$ statistic (10, 276) = 8.855 and the $p$-value for the overall regression relationship was ($p = 0.000$), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project supervision on the performance (market share) of Tigo Rwanda ($F=8.855$, $R^2 = 0.558$, Sig=0.003 at $\alpha=0.05$). The probability of the $t$ statistic (2.725) for the $b$ coefficient is $p<0.001$ which is less than the level of significance of 0.05.

The regression model further demonstrates that a one unit change in the project market share is attributed to an increase of 0.747 in the project supervision in Tigo Rwanda. The Tolerance (0.529) and Variance Inflation Factor (VIF) (1.889) indicate there was no problem of multi-collinearity (there was no overlap between the predictors) since VIF was less than 5 and the tolerance was above 0.20. This indicates that the predictor variables were appropriate for this study and were also objective for the purpose of this study.

### 4.4.2 Joint Model: Effect of Project Implementation Practices and Project Performance

#### 4.4.2.1 Joint Model: Effect of Project Implementation Practices and Project Profitability

<table>
<thead>
<tr>
<th>Dependent Variable: Project Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample: 286</td>
</tr>
<tr>
<td>Included Observations: 276</td>
</tr>
</tbody>
</table>

#### Table 4.15: Effect of Project Implementation Practices and Project Profitability

<table>
<thead>
<tr>
<th>I. Variable: PIP</th>
<th>Coefficient</th>
<th>Std. Coefficient</th>
<th>t-Statistics</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>I(Constant)</td>
<td>2.345</td>
<td>1.05</td>
<td></td>
<td>2.475</td>
</tr>
<tr>
<td>P-Scheduling</td>
<td>0.732</td>
<td>0.729</td>
<td>2.221</td>
<td>0.005</td>
</tr>
<tr>
<td>P-Mobilization</td>
<td>0.429</td>
<td>0.425</td>
<td>2.318</td>
<td>0.002</td>
</tr>
</tbody>
</table>
Regression analysis was conducted to investigate the statistical significant effect of project scheduling on the performance (profitability) Tigo Rwanda. From table 4.14, R² is the models goodness of fit for the regression line which was obtained using the correlation coefficient. In this case R² was 0.796. This means that 79.6% of variation in the dependent variable-project profitability can be explained by the variance in independent variable-project scheduling with only 20.4% of the variation in dependent variable being explained by the error-term or other variables other than project scheduling. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to understand this relationship was: 

\[ P = 2.345 + 0.732X_1 + 0.429X_2 + 0.584X_3 + 0.693X_4 + \epsilon \]

The results in the coefficient table 4.14 thus show that there was a significant effect of project implementation practices on the performance (profitability) Tigo Rwanda since \( p=0.000 \) which is less than \( p<0.05 \) at a 95% confidence interval. The computed F statistic \((10, 276) = 9.214\) and the p-value for the overall regression relationship was \( (p = 0.000) \), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project implementation practices on the performance (profitability) Tigo Rwanda \((F=9.214, R^2 = 0.796, \text{Sig}=0.000 \text{ at } \alpha=0.05)\) The probability of the t statistic \((2.475)\) for the b coefficient is \( p<0.001 \) which is less than the level of significance of 0.05.

The regression model further demonstrates that a one unit change in the project profitability is attributed to an increase of 0.732 in the project scheduling, 0.429 in project mobilization, 0.584 in project financial innovation and 0.693 in project supervision in Tigo Rwanda. However, the model indicates that improving management of project scheduling \((\beta=0.732)\) contributes more, followed by improving management of project supervision \((\beta=0.693)\), project financial innovations \((\beta=0.584)\) and lastly improving management of project mobilization \((\beta=0.429)\) respectively in increasing the project profitability in Tigo Rwanda.

### 4.4.2.2 Joint Model: Effect of Project Implementation Practices and Project Market Share

<table>
<thead>
<tr>
<th>P-F Innovation</th>
<th>0.584</th>
<th>0.576</th>
<th>2.059</th>
<th>0.004</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-Supervision</td>
<td>0.693</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.796</td>
<td>Mean dependent variable</td>
<td>1.891</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.746</td>
<td>S.D. dependent variable</td>
<td>0.729</td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>9.214</td>
<td>Durbin-Watson statistics</td>
<td>1.567</td>
<td></td>
</tr>
<tr>
<td>Prob(F-statistic)</td>
<td>0.003</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical significant effect of project implementation practices on the performance (market share) of Tigo Rwanda. From table 4.15, R² is the models goodness of fit for the regression line which was obtained using the correlation coefficient. In this case R² was 0.748. This means that 74.8% of variation in the dependent variable-project market share can be explained by the variance in independent variable-project implementation practices with only 25.2% of the variation in dependent variable being explained by the error-term or other variables other than project scheduling. Therefore, from the analysis, the regression line of the model was strongly fitted to the data. The identified model equation to

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understand this relationship was: 

\[ P = 2.795 + 0.684X_1 + 0.457X_2 + 0.573X_3 + 0.672X_4 + \varepsilon \]

The results in the coefficient table 4.15 thus show that there was a significant effect of project implementation practices on the performance (market share) of Tigo Rwanda since \( p = 0.002 \) which is less than \( p < 0.05 \) at a 95% confidence interval. The computed F statistic \((10, 276) = 8.386\) and the p-value for the overall regression relationship was \((p = 0.002)\), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project implementation practices on the performance (market share) of Tigo Rwanda \((F=8.386, R^2 = 0.748, \text{Sig}=0.002 \text{ at } \alpha=0.05)\) The probability of the t statistic \((3.087)\) for the b coefficient is less than the 0.05 level of significance.

The regression model further demonstrates that a one unit change in the project market share is attributed to an increase of 0.684 in the project scheduling, 0.457 in project mobilization, 0.573 in project financial innovation and 0.672 in project supervision in Tigo Rwanda. However, the model indicates that improving management of project scheduling \((\beta = 0.684)\) contributes more, followed by improving management of project supervision \((\beta = 0.672)\), project financial innovations \((\beta = 0.573)\) and lastly improving management of project mobilization \((\beta = 0.457)\) respectively in increasing the project market share in Tigo Rwanda.

X. Conclusion and recommendation

10.0 Summary of Findings

The research was meant to establish the effect of project implementation practices on the performance of Tigo Rwanda. The implantation practices considered included project scheduling, mobilization, financial innovations and project supervision. A total of 286 questionnaires were issued with a response rate of 96.5%. This was considered sufficient enough for the study. The results of the study shows that the industry is female dominated. The study also found that 71% of the respondents were females and 29% were males. This indicates that the communication industry is dominated by the females who account for the majority of the respondents. Majority of the respondents (49%) were aged 31 to 40 years. This was followed by 27% of the respondents being between 21 to 30 years. There were 14% of the respondents between the ages of 41 to 50 years. Those in age bracket of 51 years and above were only 9%.

A cumulative 76% of the respondents were within 21 – 40 years. This implies that in the telecommunications industry, most of the people working or doing business are mainly the youth below 40 years. This is probably due to the level of technology involved which puts many people above 40 struggling to understand. Slightly less than half (46%) of the respondents were diploma holders with 37% being undergraduate holders. Only 17% of the respondents had post-graduate degree qualifications. This shows that the respondents are capable and reliable to explore the underpinning issues related to the study. However, the number of respondents with diploma was high probably due to the age group of majority involved which could still be in colleges and universities pursuing their further studies. Majority (55%) of the respondents were having an experience level of between 1-3 years followed closely with 35% having experience level of between 4-5 years. 7% of the respondents had 6-9 years’ experience while only 4% of the respondents had experience level of 10 years and above. This implies that most of the people in the telecommunications industry just joined the industry. This could be attributed to the fact that they could have just left colleges or universities and being technology savvy, they fit best in the telecommunications sector which requires a very vibrant group of staff in terms of learning and innovations.

10.1 Conclusion

In any economy, communications infrastructure championed by the telecommunications industry is a major pillar for economic development. It provides several employment opportunities to the various segments of country’s labour force, offers market for telecommunication gadgets hence uplifting the living standards to many people and provides the infrastructural platform for further economic development. Due to the study sought to establish the effect of project implementation practices on the performance of Tigo Rwanda.

The study thus concludes that enhancing management of project scheduling contributes more, followed by improving management of project supervision, project financial innovations and lastly improving management of project mobilization respectively in increasing the project profitability and market share in Tigo Rwanda.

10.1 Recommendations

The study suggests that project manager should put more attention in improving the project implementation practices in the order of importance being project scheduling, followed by project supervision, project financial innovations and lastly improving management of project mobilization respectively to increasing their project profitability and market share.

The study suggests that Project scheduling should be executed using proper tools like Critical Path Method (CPM) and Project Evaluation Review Technique (PERT). CPM scheduling tool should be applied where there is ability to identify the critical path
through the project network which would predict the earliest date that the project can be completed. PERT on the other hand would be best placed to handle activity duration estimates in highly uncertain individual.

10.2 Suggestions for further Studies

The researcher suggests the following future research directions regarding project implementation practices and project performance:

This research recommends that more research is needed in this area to produce a comprehensive telecommunication project-implementation guide for use by investors, and practitioners/

The study was based on a cross-sectional survey design which would only give a snapshot picture at a single point in time. The researcher recommends a future longitudinal research to provide comparatively more conclusive results to the project implementation practices and project performance model.

REFERENCE


The Impacts of Social Media on Academic Achievement of Female Students at Jimma University

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Abstract - Online Social networks have gained a tremendous popularity among people all around the world, especially university students. As social media site is a vital part in today’s university students, it has also a negative impact. The objective of this study was to assess the impact of social media on the academic achievement of female students at Jimma University. To achieve this objective, the researchers employ descriptive research design that consider survey methods and partly exploratory research design. 493 female students were randomly selected based on their Grade point Average by categorizing (1.75-2.00, 2.00-3.00 and 3.00-4.00). A questionnaire was distributed among 493 female students at colleges and institutes of the university in order to explore the influence of social media on their academic performance. Grade point averages of these students were also reviewed from the registrar to identify the impact of social media on their academic performance. The Collected data was analyzed and presented in terms of frequency, percentage, and mean score of statements by using SPSS version 20.0 software. Correlation was also done to show the relationship between Social Media Network usage rate and the variables of Grade Point Average. The results of the study indicated that students who often accessed social media sites for not academic purpose had lower grade point averages than students who sometimes and rarely visited social media sites.

On the basis of the findings, the researchers recommended that female students of the university should access social media site for academic purpose and limit the time they spent on social media site. In addition to this, the university instructors should also encourage female students on using social media sites for academic purpose through online discussion, online assignment submission, online examination and evaluation.

Key words: social media, academic performance, impacts, female students, Jimma

I. INTRODUCTION

Man is a social animal. He needs to interact and live in society. Personality of human being is directly or indirectly reflected from his/her society. For becoming an active member of this larger unit one needs to have efficient communication skills from all points and edges. Communication has developed since ages as civilization and development goes hand in hand. In 21st century the
communication is faster, better and efficient the credit goes largely to technology. Internet has profoundly changed the human experience. Socialization is an important aspect of this technology. All internet users say one of their primary purposes for going online is for communication [1]. Socialization via the internet has become an increasingly important part of young adult life. The primary tools that enable socialization on internet are Social Networking Sites and instant messages. Social Networking Sites are the example of techno-oriented communication. Facebook, Friendster, Twitter, Tumblr, Yahoo Messenger, and Skype are examples of the new phenomenon of online social networking [2]. It is through these sites that people come in contact of their society members to seek mates, sharing knowledge, skills, culture, search for entertainment and participate in political spheres[3].

Social Network Service is also known as SNS. A SNS is an online service platform, or site that focuses on facilitating the building of social networks or social relations among people who, for example, share interests, activities, backgrounds, or real-life connections [4]. SNSs such as Facebook, Twitter works like this. Adolescents who become members of these SNSs communities, they will firstly get a personal profile which will show their personal information including the name, job, photo, relationship status, religion, hobbies and so on. Then networks of friends are made and other users can then click on their profiles and traverse ever broadening social networks [5].

These facilities are used by people of all age groups, but the predominant Social networking site users are youth; three quarters of adult internet users under age 25 have a profile on these sites [6]. The popularity of these sites is attracting more and more youth users. In 2005, only 8% of adult internet users had an online profile, today that number has quadrupled to 35%” (6). The excessive use of these sites not only have long lasting effect on psyche of students but also affects the physical, mental and social aspect of life. Sometimes these sites also affect the academic achievement of the student because they don’t want to leave that particular aura and thus their concentration stands divided [7].

Besides the above mentioned view there is yet an arena of knowledge that holds the view that every student is unique in their own way; some are able to express themselves openly are termed as extroverts while others are shy in nature are called introverts. Social networking facilitates open communication, leading to enhanced information discovery and delivery [8]. In addition, it does not require one to voice out their opinions and ideas. Individuals are able to choose the preferred option and that is to communicate through social networks.

Social networking sites have brought both good and bad to the present generation. Social networking site has helped many students to acquire knowledge from one another over internet without necessarily have to meet physically [9]. On the other hand, social networking sites have caused many problems [10]. For instance many students have lost their interest in their studies as they spend most of the time on these sites [9 & 10].

The time spent on online social networks was found to be heavily influenced by the attention span of the students. Specifically, we determined that the higher the attention span, the lower is the time spent on online social networks [9]. Further, attention span was found to be highly correlated with characteristics that predict or influence student behavior, such as their perceptions about society's view of social networking, their likes and dislikes of online social networks, ease of use of Online social networks [9].
On the other hand there are many researches highlighting that the use of social networking sites does not affect academic achievement adversely. Often students use social networking websites to discuss their academics issues formally and informally and also to interact with their instructor, teachers and professors [11]. The University of New Hampshire agrees, and believes that current college students grew up in the technology era and social networking is now just a part of a student's daily routine. Their research show that 63% of heavy users received high grades, compared to 65% of light users' [6]. The University of New Hampshire said that a majority of students use social networking for social connections and entertainment, but are also using it for education and professional reasons.

Although minimal researchers have previously examined the impact of social media on academic performance of student in general, they have failed to target females in higher learning institute in Ethiopia. As a country, improving the academic achievement of female students are the major issues and all the efforts and resources are engaged in it. Government, non-government organizations and international partners all are giving their utmost effort to improving the academic achievement of female students and to assure quality of education. But, the effect of using social media on the academic achievement of university students, especially female students is on the bottom of their priority list. That’s why there is no information and studies on the effect of using social media on academic achievement of university students in this country.

Studies have not been conducted so far on the effect of social media on the academic achievement of female students in higher education in Ethiopia. Hence, findings from this study will provide a starting point for university authorities and all concerned groups to identify the effect of social media on academic achievement of female students in higher education’s and take appropriate measures. Moreover, this study would serve as baseline information for future intervention program on effect of social media on student academic achievement. Last but not least it will be helpful for higher education program planners to consider effect of social media on students’ academic achievement in their priority education issues. Therefore, this study was conducted to identify the impact of social media on academic achievement of Jimma University female students.

Operational Definition
Social Media: Group of internet based application that allows the creation and exchange of user generated content.

Social Networking Sites: A website where people put information about them and can send to others.

Social Media Network: The use of internet to make information about yourself available to other people especially people you share an interest with to send messages to them.

Academic: It is concerned with Studying from books & practical work.

Students: Female students who are Studying at Jimma University.

II. LITERATURE REVIEW

Previous literature recognized the challenges that are connected with using social media in higher education. [12] Carried out an empirical study of social networking usability among University students in the United Kingdom. The study involved 76 participants for the questionnaire and 14 granted interviews. The study discovered that, there are 5 major challenges of social networking and its relation to learning such as studying originality and copyright issues feeling of information constraint. Teachers sometimes are not up-
to-date and could not understand how to integrate and take advantage of social software into their classes. The findings of the study confirmed the earlier issues outlined by [13] according to their next generation research in three Australian Universities.

Using social media by University students is certainly a fascinating portion of research for educationists and social scientists. [14] Maintain that in the available literature there are beneficial designs and styles of employing it at school level. It describes the introduction of contents and focuses on how to share, interact, and collaborate and socialize by its use. There appear different top reasons to justify using social media in greater education. It usage was confirmed by preserve setup its familiar with enhance study encounters of students by provision of e-support services on their behalf [15]. It's familiar with facilitate communication among and between students in virtual cities. Amongst others, the Face book appears being most likely probably the most favorite was suggested as a means of communication for reaching students [16].

Some social media such as Wikipedia and to some extent blogs encourage investigative-based and collaborative activities among students in higher education. This open access for active participation and can therefore create opportunities for effective learning. Linked with this principle of collaborative development among learners, social media enable learners and teachers to share and publish information as a result of the learning activity (e.g., course materials such as course syllabus, course notes, assignments, test cases, etc) and invite feedback from peers. By publishing and presenting their work to a wide audience through blogs, wikis, or podcasts, learners benefit from the opportunity to appropriate new ideas, and transform their own understanding through reflection [17].

Students especially at higher level of learning can function collaboratively through exploring the opportunities given by online social atmosphere to resolve certain academic issues or issues with their peers [18&19] This is indicative that through collaborative or team learning through integration of social media, students can establish positive contact, using the goal of working towards particular final results, both in offline and online modes [20].

Social Media to assist Collaborative Learning (SSCL) might be the pc network found in learning atmosphere for encouraging the students in learning process and cooperates in groups with the group process, communication involving the students, experts and workplace entrepreneurs. The understanding and experience is viewed since the tools for understanding construction that's precise and matches the particular context in solid existence [21].

According to [22] Facebook users often time experience poor performance academically. Similarly, [23] posit that social media is negatively associated with academic performance of student and is a lot more momentous than its advantages. Internet addiction consequently gave rise in internet usage within the last couple of decades. [24] Recommended that addicted users prefer using internet setting back their personal and professional responsibilities which ultimately leads to poor academic performance.

According to [25] pointed out that Facebook users devoted lesser time to their studies in comparison to nonusers did and subsequently had lower GPAs. [26] Also mentioned that among various unique distractions of every single generation, Facebook remains a major distraction of current generation. According to [27] impairment of educational performance and internet dependency are correlated by utilizing synchronous communication programs including internet sites and forums. There are benefits and risks associated with using any social network. There have been reports regarding its effect on students’ academic performance. Some researchers investigated the end result of social networking usability among College students’ and with their academic performance. They found a poor effect and influence when the media is overuse in such a way that do not academically improve learning or its process [28- 31]. Other
Researchers examined this same problem but found either no significant relationship between using social networking and student academic performance [32&33], or really a factor in students’ academic performance [34].

III. MATERIALS AND METHODS

Study Design and Setting

Its university based study utilizes descriptive cross-sectional research design that consider survey methods and partly exploratory research design. By using this method the researchers are going to describe the existing impact of social media on female academic achievements at Jimma University from December, 2015- March 2016. The population of this study comprises of all female students from seven colleges & one institute registered at the university in academic lender of 2014/2015. Freshman female students were excluded from this study since they have no GPA during the study period.

Nature and Instruments of Data collection

To achieve the objective of this research, the researchers were used survey questionnaire measures academic performance, time spent online using Facebook. The questions are formed by Likert scale, interval options and yes or no questions. The research instrument was developed based on the Literature, existing survey and previous studies.

Sampling Technique/ Sample Size

The researchers used Random sampling methods. Accordingly 493 female students were taken randomly from all colleges & institute.

Data Analysis Procedure

Obtained data was checked for error and then data entry was completed and final data was analyzed by using SPSS VERSION 20.0 software. Simple tables, Mean, frequency percentages, & figures, was used in the presentation and analysis of the data generated for the study. Correlation was done to show the relation between SMN usage rate and the variables of GPA and relation between SMN usage rate and the variables of age. Correlation coefficient at 99% confidence level was done to show relation between SMN Variables & SAP.

Ethical consideration

This study was done according to the research protocol of Jimma University. The proposed study was submitted to the office of v/president for Research & technology transfer of Jimma University for review and ethical approval. After it has been reviewed by relevant IRB, Ethical clearance was obtained to conduct the proposed study.

IV. RESULT AND DISCUSSION

Relationship between Social Network Variables and Students Academic Performance:

To study the relationship between use of social networks and students’ academic performance, we selected variables that can identify uses and gratification that the students draw from social networks. These variables show effects of social networks on students’ academic performance and the futuristic online and offline paradigms that can enhance teaching methodology.
Table 1. Descriptive Profile of the Respondents.

<table>
<thead>
<tr>
<th>Variables</th>
<th>n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>20-25</td>
<td>325(65.9)</td>
</tr>
<tr>
<td>≥26</td>
<td>168(34.1)</td>
</tr>
<tr>
<td>College</td>
<td></td>
</tr>
<tr>
<td>JUCAVM</td>
<td>60(12.2)</td>
</tr>
<tr>
<td>CHS</td>
<td>75(15.2)</td>
</tr>
<tr>
<td>JIT</td>
<td>67(13.6)</td>
</tr>
<tr>
<td>Low &amp; Governance</td>
<td>45(9.1)</td>
</tr>
<tr>
<td>Natural Science</td>
<td>56(11.4)</td>
</tr>
<tr>
<td>Social science</td>
<td>70(14.2)</td>
</tr>
<tr>
<td>BECO</td>
<td>75(15.2)</td>
</tr>
<tr>
<td>Education &amp; Behavioral Science</td>
<td>45(9.1)</td>
</tr>
<tr>
<td>Religion</td>
<td></td>
</tr>
<tr>
<td>Muslim</td>
<td>117(23.8)</td>
</tr>
<tr>
<td>Orthodox</td>
<td>189(38.4)</td>
</tr>
<tr>
<td>Protestant</td>
<td>156(31.6)</td>
</tr>
<tr>
<td># Others</td>
<td>31(6.2)</td>
</tr>
<tr>
<td>Year of Study</td>
<td></td>
</tr>
<tr>
<td>2-4</td>
<td>373(75.7)</td>
</tr>
<tr>
<td>≥5</td>
<td>120(24.3)</td>
</tr>
<tr>
<td>Grade average point (GPA)</td>
<td></td>
</tr>
<tr>
<td>1.5-2.0</td>
<td>39(7.8)</td>
</tr>
<tr>
<td>2.0-3.0</td>
<td>410(83.2)</td>
</tr>
<tr>
<td>3.0-4.0</td>
<td>44(9.0)</td>
</tr>
</tbody>
</table>

# others-Catholic, Jehovah & Tradition

The above data shows the demographic information of students in this study.

Uses of Social Media Network (SMN)

As Fig 1 below shows, from a sample of 493 female students we found that all the students used one or the other social networking site. The social networking sites that students used for academic purposes included YouTube, twitter and Facebook. Facebook was the highest SMN used of all &twitter was the least used of all the websites.
Others include; messenger, Viber, Skype & WhatsApp

Use of SMN on Mobile Phones

Seventy-six percent of the respondents reported that they used a social media networking site on phone. This increased the approachability and flexibility of being in touch. Smart features available on social media networks like reading RSS feeds, location tagging and status updates were popular uses of social network on mobile phone. These were not directly related to education (Fig 2).
Time Spent on SMN:
The respondents reported the number of hours they spent on social networks per day. 89 (18.1%) of the respondents spent one hour, 198 (40.2%) spent two hours per day and 164 (33.3%) spent four hours. They were no respondents who spent zero hours on the social media networks. The consumption levels greater than four hours are the highest (see Fig 3).

Number of Social media Networking Sites Used
The number of social media networks used by the students also varied. 13% used only one social network, 49% used two, 27% used three, and 11% used more than social networks. The popularity of SMN cannot be ignored with 49% using at least two social networks (Fig 4).
4.6. Purposes for which the students used social media network sites:

The next variable in this assessment was the purposes for which the students used social media network sites. The students were able to point out the different purposes for which they used the SMN. In Table 2 we see that the highest score of 65% is for chatting & followed by 54% for downloading music/video. Only 32% is used for searching assignment/quizzes. Uploading music/video, Blogging, Posting photos & Communication with teachers/class fellows was the least purpose used by the students (4%, 5%, 16% & 18%) respectively.

Downloading music and videos were not only educational but consisted of several genres. The highest score revealed that the students used it for chatting. Downloading music/videos, posting photos and chatting can be categorized as entertainment use.

Educational activities like publishing articles, searching for assignment/quizzes, communicating with teachers comprised of a lesser score. Only 4% used SMN for uploading videos. 32% for searching for assignment/quizzes, 8% for blogging, 18% communication with teachers. This reflects that SMN were used by students for entertainment mostly and less for educational purposes.

<table>
<thead>
<tr>
<th>Purpose</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downloading music/video</td>
<td>54%</td>
</tr>
<tr>
<td>Uploading music/video</td>
<td>4%</td>
</tr>
<tr>
<td>Posting photos</td>
<td>16%</td>
</tr>
<tr>
<td>Chatting</td>
<td>65%</td>
</tr>
<tr>
<td>Blogging</td>
<td>5%</td>
</tr>
<tr>
<td>Communication with teachers/class fellows</td>
<td>18%</td>
</tr>
<tr>
<td>Searching for new friends</td>
<td>20%</td>
</tr>
<tr>
<td>Searching for assignment/quizzes</td>
<td>32%</td>
</tr>
<tr>
<td>Any Others</td>
<td>12%</td>
</tr>
</tbody>
</table>

Community Groups Sharing:

Nearly all respondents were members of a community or a group on social networks. The kind of communities they joined was for educational, entertainment, information and for any other uses. 102 (20.7%) used SMN for educational purposes, 122 (24.7%) for entertainment, 207 (41.9%) for Information and 62 (12.6%) for any other use.

The maximum groups and communities joined by students were for information. The students chose groups that were related to their discipline and joined educational communities with which they shared common interests (Fig 5)
The students were asked the influence of using SMN on their academic performance. 58% of the respondents outline that using SMN has negative impact on their academic performance, 42% outline using SMN has a positive impact on their academic performance (fig. 6).

**Correlation between SMN usage rate and the variables of GPA**

To calculate the magnitude of the relationships or correlations between the various variables the researcher examined the $r$ values. As the value of $r$ increases, the strength of the relationship between the two variables increases and vice versa.

The value of $r$ usually ranges between -1 to 1 and could be either positive or negative. In fact, the sign of positive or negative means only directionality in this relationship and has no numeric value. If the sign of $r$ is positive that means the increase in value of one variable leads to an increase in the value of the other one, whereas, the negative sign means that if the value of the first variable increases that means a decrease in the value of the other.
Besides, if the value of r is 0.8 or higher this means that a strong relationship exists between the two variables. If the value of r is between 0.4-0.7 it is considered a moderate relationship. But, if r is less than 0.4 the relationship is considered weak.

According to Table 3 below the correlation between (the times spent on SMN per week) and (most recent cumulative college GPA of the students) is a positive weak one. Therefore there is no statistically significant effect of time spent on SMN and students’ academic performance represented in their GPA. These findings answer the major research question in this study.

| Table 3: Correlation between SMN usage rate and the variables of GPA Correlation |
|---------------------------------|---------------------------------|--------------|
| Sum Total of week hours         | Pearson Correlation sig(2-tailed) | N             |
| Weeks +weekends in week         | 1                               | .031         |
|                                 | 164                             | .762         |
| What is most recent GPA          | Pearson Correlation sig(2-tailed) | N             |
|                                 | .031                            | .762         |
|                                 | 44                              | 44           |

According to Table 4 below the correlation between (the times spent on SMN per week) and (age groups of the students studied) is a negative weak one. Therefore there is no statistically significant effect of students’ age and time spent on SMN. These findings answer the our research question in this study.

| Table 4: Correlation between SMN usage rate and the variables of age |
|---------------------------------|---------------------------------|--------------|
| Sum Total of week hours         | Pearson Correlation sig(2-tailed) | N             |
| Weeks +weekends in week         | 1                               | .082         |
|                                 | 164                             | .626         |
| What is age?                    | Pearson Correlation sig(2-tailed) | N             |
|                                 | .082                            | .626         |
|                                 | 168                             | 168          |
Correlation between SMN Variables and SAP

The relationship between the student academic performance (SAP) with interactivity with peers (INT_P), interactivity with the teacher (INT_T), engagement (ENG) and collaborative learning (CL) were analyzed.

Table 5 shows the Pearson correlation coefficient at 99 % confidence level. The best correlation was found between the student academic performances (SAP) with engagement (ENG) with correlation coefficient of 0.666. The letters INTP stand for interactivity with peers, letters INT_T stand for interactivity with the teachers, letters ENG engagement, letters CL collaborative learning and letters SAP students’ academic performance.

Result of Pearson correlation shows that there is statistically significant positive relationship between interactivity with the teachers and interactivity with peers (r= 0.554, P< 0.01). Results demonstrate that relationship between these two construct is moderate and interactivity with the teachers and interactivity with peer’s combination contributing moderately towards students’ academic performance. Engagement correlation results with interactivity with peers (r= 0.452, P<0.01) demonstrate moderate positive relationship, while engagement results with interactivity with the teachers (r= 0.604, P< 0.01) demonstrate positive relationship showing that these two construct are contributing moderately towards students’ academic performance. Similarly, construct of collaborative learning correlation results with interactivity with peers (r= .488, P< 0.10), interactivity with the teachers (r= .533, P<0.10) and engagement (r= 0.557, P< 0.10) demonstrate positive and significant relationship. These results highlight that collaborative learning relationship with interactivity with peers, interactivity with the teachers and the engagement, is contributing towards students’ academic performance.

<table>
<thead>
<tr>
<th></th>
<th>INT-P</th>
<th>INT-T</th>
<th>ENG</th>
<th>CL</th>
<th>SAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT-P</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INT-T</td>
<td>0.554**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENG</td>
<td>0.452**</td>
<td>0.604**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CL</td>
<td>0.488**</td>
<td>0.533**</td>
<td>0.557**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SAP</td>
<td>0.5622**</td>
<td>0.572**</td>
<td>0.666**</td>
<td>0.632**</td>
<td>1</td>
</tr>
</tbody>
</table>

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

While the dependent variable students' academic performance has positive and significant correlation with collaborative learning (r= 0.632, P< 0.01) and positive correlation with collaborative learning. Correlation results of students' academic performance with interactivity with peers (r= 0.622, P < 0.01); interactivity with the teachers (r= 0.572, P<0.01); engagement (r= 0.666, P < 0.01) so the positive and significant correlation with engagement. These results highlight that students' academic performance relationship with interactivity with peers, interactivity with the teachers and the engagement, is contributing to improve students' academic performance.

The table 6 indicate that interactivity with peers positively and significantly with collaborative learning (β2 = 0.283, p < 0.05) While support the interaction among the students may improve the students’ academic performance through the collaborative learning. Interactivity with teachers positively and significantly with collaborative learning was (β3 = 0.126, p < 0.05). The interaction between students and teachers found to be lower than interactivity with peers. The engagement also has positively and significantly with collaborative learning with standardized beta coefficients of 0.283. The standardized beta coefficient between the collaborative learning with standardized beta coefficients of 0.283.
learning and students’ academic performance found to be a positively and significantly with value of 0.164 at significant level less than 0.05.

In line with the outcome of this study to understand students’ academic performance by using social media in higher education, the following have been discovered: To acquire a general satisfaction of social media since it encourages and facilitates student utilization of social media for collaborative learning, and boost the education and experience with a students. In terms of interactivity with peers on social media and acquired a higher percentage when it comes to students’ academic performance at University since it influences it to be simple for student to go over questions along with other students through social media It is easy to networking with peers and interact with them because it is the same age, class and education level.

In terms of the students’ academic performance with engagement acquired a typical percentage when it comes to academic performance of students at University since it provides coalition and sharing of knowledge in the class and library by using of social media any time. The collaborative learning with social media usage and acquired an average percentage when it comes to academic performance of students at University. Since it helps make the students feel confident enough to presenting the social media by collaborative between peers, teachers and engagement within the class.

### Table 6: The standardized beta coefficients

<table>
<thead>
<tr>
<th>Framework</th>
<th>Standardized Coefficients</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL (β1)</td>
<td>.164</td>
<td>2.126</td>
<td>.026</td>
</tr>
<tr>
<td>INT_P (β2)</td>
<td>.283</td>
<td>2.146</td>
<td>.041</td>
</tr>
<tr>
<td>INT_T (β3)</td>
<td>.126</td>
<td>2.337</td>
<td>.081</td>
</tr>
<tr>
<td>ENG (β4)</td>
<td>.283</td>
<td>2.754</td>
<td>.005</td>
</tr>
</tbody>
</table>

a. Dependent Variable: student academic performance (SAP)
b. Predictors: (Constant), collaborative learning (CL)
c. Predictors: (Constant), collaborative learning (CL), interactivity with peers (INT_P), interactivity with the teacher (INT_T), engagement (ENG).

Finally, In terms of the students’ academic performance with interactivity with teachers of utilizing social media and acquired a Lowest percentage sometimes not allowed to communicate with teachers or shy students, but are good since it provides those more understanding form teachers, and academic achievement in education.

### V. CONCLUSION AND RECOMMENDATION

The study was conducted to examine the impact of social media on female students’ academic achievement at Jimma University. Therefore; the study discovered that the use of social media had affected academic performance of female students negatively. The findings show that there is a correlation between the students’ academic performance and their usage of social networks. Finally it revealed that the students tend to use social networks for social purposes than the academic ones in the university.

Based on the findings, we recommend that
Female students of the university should think more about the balancing equation of social media and academics. We also recommend that university instructors should encourage female students on using social sites for academic purpose (for e.g. online discussion on assignment, online examination, online paper submission and online evaluation). The gender and youth office of the university should aware female students on the advantages and disadvantages of social media usage in collaboration with concerned university leaders and professionals.

ACKNOWLEDGEMENTS

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REFERANCE


34. Pasek & Hargittai. Facebook and academic performance: Reconciling a media sensation with data. First Monday, 2009, 14(5-4).
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Multivariate prediction of electricity consumption in Iran 2025 after statement with great countries of UN Security Council

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\textbf{Abstract}- Today among the various energies conspicuous, electric power is a significant source of industrial energy that is important for industries, agriculture and household use. Therefore, this article aims to study the trend of probable power generation in Iran, its state of consumption following Iran’s vision plan in the year 2025. Although, there are some studies on Iran’s electricity demands; the researchers studied on the relation between electricity consumption and GDP in a bi-variable assumption. Thus, this study focused on a multi-variable model to predict efficiently the electricity need for Iran 2025. During the recent years following sanctions, development of electricity power industry in Iran has been faced to some problems. Therefore, if the capacity of power plants in Iran would not be increased, it is anticipated that the relative probable power outages control would be unavoidable in the country, especially during peak hours. Accordance with international agreements made between Iran and effective United Nations Security Council members, Iran’s electricity industry is going to prepare a development plan for increasing the present capacity. The most significant methods of domestic power generation in Iran include combined cycle, steam, gas, hydroelectric and other renewable methods. The generation rate of these methods is considered a target variable for predicted processes. The article has used a methodology based on the electricity power generated in different methods annually as the variables to plan the use of multilayer neural network for anticipating the future power generation and the required investment. Also, trend of some important parameters affecting the rate of electricity demand were investigated i.e. GDP, Steel production, Urban population and oil production in Iran. The performed research study in this paper is focused on production trend and diverse power generation methods in the country during the various years up to 2025, and the analysis of this report is based on this classification.

\textbf{Key words}: Electricity generation, Iran, Neural network, Prediction, Security Council.

\section{I. Introduction}

Global power industry has become more significant due to urban life and auto industrial development. Nowadays, develop of equipment and machines that work with electricity increasingly need the suitable power supply to answer the requirements of people and also the industries. Anticipating the electricity need is an important issue thus there are lots of studies focused on this area [1-6]. Although, there are some studies on Iran’s electricity demands [1, 2]; the researchers studied on the relation between electricity consumption and GDP in a bi-variable assumption. Thus, this study focused on a multi-variable model to predict efficiently the electricity need for Iran 2025. Iran, having the population of about 78 million and the area more than 1.6 million square kilometers is known as a developing country [7]. In accordance to International Energy Agency, this country supplies more than 90% of energy from fossil fuel; the main reason is the capacity of Iran’s crude oil and natural gas production equal to 162 Mtoe and 134 Mtoe respectively as the world seventh and forth rank [8]. Since domestic power supply requirements in any country is one essential factor in sustainable development, prediction of required electricity in the coming years is indispensable. Accurate prediction is a significant issue in the supply and demand management since it cannot be saved and expected to be used immediately. That is why numerous studies have been performed on power supply and demand predictions.

Since accurate prediction of power consumption is specifically essential for countries’ energy plans, during the previous decades new techniques have been used to predict the power consumption to anticipate the accurate requirements for the future. Artificial Neural network frequently were used as a suitable method to forecast the energy consumption. In a survey carried by Kaytez et al. [9] the LS-SVMs method based on regression analysis and Artificial Neural Networks (ANN) was used to predict the electricity consumption in Turkey. In the model the installed capacity and the population rate in Turkey from 1970 to 2009 were considered as the independent variables. Zhang and Wang [10] based on daily electricity consumption in China, assert that in view of high increasing of demand energy, normal regression model does not provide accurate energy consumption prediction. Therefore, they applied the Fuzzy Wave Neural Network (FWNN) to combine experts’ knowledge with target properties to overcome the disadvantages of forecasting methods in power consumption anticipation. Saravanan et al. [11] used the ANN and linear regression analysis to specify annual consumption

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predictions during the years 2011 to 2020 in India. For this purpose, population and GDP were used as input variables and anticipated power consumption as output variables were generated. The authors concluded that ANN model is quite flexible and it can provide the optimal solution of future demand anticipation. Marwala and Twala [12] used the Auto Regressive Moving Average (ARMA) neural networks and fuzzy neural models for future consumption anticipation in South Africa. The input data were used from the past records collected monthly from January 1985 up to December 2011. The results revealed that fuzzy neural model is more capable than other used methods; also they concluded that the neural network is better than ARMA. Azadeh et al. [13] used the Artificial Neural Network (ANN) for prediction of annual electricity consumption in high energy consumption industries. In this survey, chemical substances, metal bases and non-metal mineral industries were defined as the high energy consuming industrial sectors. Azadeh et al. used the actual data of industrial energy consumption collected between the years 1979-2003 in Iran. The authors concluded that the normal regression model for prediction of energy consumption of high energy consuming industries is not precise and accurate because the energy consuming in these industries changes unpredictably. Although artificial neural networks are generally used for short term consumption anticipation, this article express that the ANNs can be used for long term anticipation as well. Also, in another study performed by Azadeh et al. [14] the artificial neural networks (ANNs) for modeling of demand prediction of electricity power in power supply sectors were applied for Iran’s demand as well. They compared the results obtained from ANN and those obtained from the simulated based ANN model. The used data is related to Iran’s national electricity demand from 1994 to 2005. Also, Ringwood and Bofelli [15] developed an artificial neural networks (ANNs) for modeling of demand prediction of electricity power in power supply sectors. The used data is related to Republic of Ireland’s national electricity demand. The article is focused on three various time scales: annual (fifteen years ahead), weekly (coming three years) and hourly (up to the next twenty-four hours). Since residential power consumption in most developed countries has increased remarkably during the past years and especially during the summer, studies on the relation of electricity demand and electrical consumers (especially air conditioner) are significantly important. That is why a survey was carried by Marvuglia and Messineo [16] using a model based on Artificial Neural Network (ANN) for short term prediction of family electricity consumption (an hour) performed in neighboring of suburban area of Palermo (Italy). Hassan et al. [17] aimed to evaluate various algorithms cumulative efficiency for forecasting demand market in Australian energy market (AEMO) and New York Independent Site (NYISO). The authors used the single neural network models in a group. The research is formed of a 100 heterogeneous Neural Network Model structure group to create random order parameters. The NN models output is combined with three various cumulative algorithms. Observations indicate that cumulative algorithm have better performance and higher accuracy in comparison with individual NN models. In another research carried by Xiufeng and Jian [18] five layer Fuzzy Neural Network (FNN) were introduced. The aim was to optimize network structure, introduce new methods of knot and promote the algorithm skill. Also, to learn the network of real data, Chinese data from 1980 till 2006 were applied in the study. In review and comparison of the results using real data of power consumption in 2006 and predicted data using FNN authors concluded that the method used is a high performance method and also accurate to anticipate the results up to 96.7%. Jia-hai and Xing-ping [19] using an improved neural network (BP) presented an adaptive learning method for power consumption forecast in China. The GDP, electricity energy consumption growth and the growth rate of the secondary industry were considered as input variables and in sequence the power consumption of future year was predicted as the output. Simulated model of BP neural network improved the flexibility of conventional method of BP neural network in the presented article.

During the recent years, power industry in Iran is not sufficiently developed to reply the countries’ present and future needs due to extensive sanctions. However, Iran and great countries’ statement in UN Security Council has furnished the ground for various industrial development including electricity power industries. The issue has provided mutual opportunities for Iran on one side and global investors on the other side; that is why this article attempts to envision the investment requirements in this sector for the next ten years, in line with Iran ending 2025 vision documentary using a neural network prediction model. Iran’s government urge to reach the objectives set in 2025 vision documentary, thus in this research capacity of electricity production in year 2025 is anticipated. In our survey, a multilayer neural network was applied based on the significant parameters like GDP, urban population and urban population growth and also oil production (as the most significant foreign exchange earnings in Iran) steel production and its consumption (as an important factor that shows the rate of development) to distinguish the future electricity consumption in Iran 2025.

II. METHODOLOGY

**Artificial Neural Network (ANN)**

In order to predict the required investment for 2025 in Iran electricity industry the Artificial Neural Network (ANN) is utilized in this investigation. In fact, there is a network which conceives node as artificial neuron and these types of neurons are known as Artificial Neural Network (ANN). In other words, an artificial neuron is computational model simulated from real human neurons. When modeling nerves, their complexities are disregarded and only the basic concepts are valued because other modeling approaches are arduous to be used. In a simple glance, nerve modeling must include inputs which act as synapses. These inputs are multiplied by weights to determine signal strength. Eventually a mathematical operator determines the certainty of activeness; in case of positivity the output is specified. Hence, an Artificial Neural Network (ANN) processes information by using a simplified model of real nerve. In view of aforesaid, a recommended simple model for defining a neuron can be ‘node in the Artificial Neural Network (ANN)’. The model is presented in Fig. 1. Undoubtedly increase in the number of nodes makes the models difficult to be solved; therefore, new
methods are exigent to solve these issues. Here, the process of determining optimal of weighting and their value adjusts is mainly recursive. For this purpose, the rules and the known data are applied to educate the network thus network competence is acquired and miscellaneous algorithms are need to be proposed. All striving mentioned in this approach is used to make a network to anticipate the ideal output.

**FIG. 1 – AN ARTIFICIAL NEURON SCHEME**

**MULTI-LAYER PERCEPTRON (MLP)**

In order to use the ANN, in this research a Multi-Layer Perceptron (MLP) was applied as followed. In fact, one simple and at the same time effective proposed arrangements to be utilized in modeling of real nerve is Multi-Layer Perceptron (MLP). These arrangements are made up of an input layer, one or more hidden layers and an output layer. In this structure all neurons in one layer are connected to the neurons of subsequent layers. This arrangement is called a network with full connectivity comprises. Fig. 3 manifests three layer perceptron network schemes. It can simply be concluded that the number of neurons of each layer is independent from the number of neurons in other layers. It should be noted that in Fig. 2 each aggregated circle represents aggregated operation and thresholding. In fact, each solid circle in this figure is a model of collector and block thresholding. It is shown in the below form as well to ease the display.

**FIG. 2 - THREE-LAYER PERCEPTRON NETWORK SCHEME**

*Learning via Artificial Neural Network (ANN)*

The main idea was propounded by Warren McCulloch and Walter Pitts [20] whom were simulated by the functions of neurons of human brain. The neural network is trained to solve the problems and in fact there are no preplans. Actually adjusting the weights of input of each neuron proportionally learn the network. The regulation is based on the model that shall incur with or without supervision.

In this article analysis of dependent variables are initially specified. For this reason, in addition to consider of total power generation during various years in Iran, different methods were studied separately. As a result, our target variables were selected as below:

1. Electricity generation by steam & Electricity generated by gas & Electricity generated by Combined Cycle (response 1)
2. Electricity produced by hydroelectric method & nuclear energy (response 2)
3. Total generation of electricity by other methods

The total power generation is higher than the existing set in form 1 & 2 because power generation in Iran can be applied in other methods.

For prediction of each of the above mentioned two types of independent variables are taken into account. The first group are related to variables of time-series variation for each target variables. This method for prediction of power generation is taken as work basis, based on previous two last years for anticipating the target year. Although, in view of the fact that Iran’s total generation during nineteen years (1975-2014) is available, that seems good enough, the impact of other variables over each dependent variable was also
be studied. Due to this, a list of candidate variables for studying the rate of dependency to power generation in Iran were examined as mentioned below:

a) GDP per capita in Iran
b) Crude Oil Production in Iran
c) Urban population in Iran
d) Urban population growth in Iran
e) Steel Consumption in Iran
f) Steel Production in Iran

Bennouna and Hebil [21] discussed on close relation between GDP per capita and power consumption in Morocco. Also, Apergis and Tang [22] based on study on the statistical data from 85 countries showed that there is a close correlation between GDP and energy consumption in Iran and lots of other countries investigated in their study. Our data from Iran proves the relation between GDP and electricity generation in year 1995 up to 2014 as well. Figure 3 shows comparison between GDP per capita in Iran and the electricity generation. The R-squared i.e. coefficient of determination is about 94.8

One important parameter effects on Iran’s income is the oil production rate yearly. Therefore, the correlation between oil production in the country and the electricity consumption was investigated as well. The result shows that there is a close relation between oil production and electricity consumption because r-squared is about 0.91. Also, the correlation between electricity consumption and four different parameters i.e. urban population, rate of urban population growth, steel consumption and steel production in Iran were studied as well. The results show that there are close relation between electricity consumption and the above parameters because the r-squared determined for these parameters are between 0.94 and 0.99

To evaluate the association of each variable over other response variables the rate of correlation is calculated. Based on this, in order to determine each variable as an input variable the neural network method is applied too.

The next stage, by utilizing the determined input, the neural network designed is learned to obtain regulated network parameters for future year predictions. Since the objective of this article is prediction of target variables in the horizons of 2025 the concerned network input shall be used for predictions in the same year. For this purpose, it is assumed that until 2025 war, earthquake and other force major events that may alter the overall pattern of results would not occur, so the overall pattern of data preserved is stable. On this basis, the nonlinear regression equation of each dependent and independent variable as inputs and outputs of the neural network can be obtained. These equations show the created transformations for each data during various years without observation of other variables impacts over them. Keeping the assumption of constant pattern data based is the advantage of these equations when they apply using the required input for power generation prediction up to 2025.

Table 1 exhibit the collected data of electricity generated by Ministry of Energy of Iran [23]. All data are arranged by electricity generation method in Iran during 1995 up to 2014 separately. Certainly, power generation can also occur using other methods such as atomic energy, wind power plant, solar power plant and combined cycle; the power generation with mentioned methods is totally shown in the last column.

**TABLE I. THE RESULTS OF POWER GENERATION IN IRAN USING DIFFERENT METHODS DURING 1995 TILL 2014 (MW)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Method</th>
</tr>
</thead>
</table>

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Production Method Selection

Production method selection varies according to demand and regional conditions. Each power plant has its own advantages and disadvantages. Although rapid technological development makes the hope to reduce the costs of various power plants, some governments, which are the great oil and coal producers, prefer to use the coal, gas and oil for electricity power plant. However, energy production in industrial regions is more economical, and the largest world energy supply resources for electricity include: coal, natural gas, hydroelectric (hydropower), nuclear energy, oil and derivatives; other resources are placed in the same last row. Due to environmental pollution issues, power plants are usually established far from urban and residential areas. When there is high requirement and instant need for electrical energy the power cannot be supplied from some renewable energy such as sunlight and wind power. Further, the type of power used is also important to choose the type of power plant. As an example, gas source can easily be reduced or increased in load; also nuclear power plants can generate high scale of electrical energy easily; and hydropower is usually installed in areas where the ability of water movement from higher attitude to the lower level exists in capacity to drive the turbines. However, this type of power plant is not feasible in Iran because water storage capacity is limited in this country and during the year the consumption load is existed. Iran’s capacity of producing the crude oil and gas is high and in fact its export them to other countries as the 8th producer in the world. Although the renewable energies protect the environment for future generations, the Iranian investors assume that the renewable energy resources such as hydro power, solar power, wind power, tidal etc. in view of present existing technologies are highly costly. Therefore, in a long term the investors in Iran have mostly preferred to produce the electricity via oil and gas resources.

Analysis of Effective Factors on Production Process

In this section, Iran’s collected data in various fields effective on energy consumption are reviewed. The variables used in this study for predicting the future demand of electricity in Iran are as follows:

- GDP per capita
- Oil production (as the main source of Iran’s income)
- Urban population (as the main electricity consumer)
- Urban population growth (as the stimulus of consumption)
- Steel consumption (as the factor of development)
- Steel production (as the main electricity consumer)

The reason of choosing above variables are discussing as follows. Apergis and Tang [22] concluded that GDP can effect on energy as an important factor; thus in this study trend of GDP was used in combine with some other important factors to predict the future power demand in Iran. Also, the main income of Iran’s government is based on the oil export and this factor affect the infrastructure investment in the country. On the other hand, the urban population in Iran was increased in Iran from 36 to 56 million between 1995
and 2014 that rise the electricity consuming. In addition, one of the most electricity consuming industries in Iran is steel factories that affect the electricity demand. Finally, steel consuming from both sources of internal producing and imported one can affect the electricity demand. Thus these factors were chosen as the variable of this study. Table 2 reveals Iran annual statistics for each of these factors. As observed, the presented statistics indicate the increasing trend in general. Even if at times there were some falls in an area, once again it regained and returned to be increased.

### Table 2 – Annual Statistics of External Factors

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP per capita (US $)</th>
<th>Crude Oil Production (MT)</th>
<th>Urban population</th>
<th>Urban population growth (%)</th>
<th>Steel Consumption (KT)</th>
<th>Steel Production (KT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>1984.17</td>
<td>3643</td>
<td>36423717</td>
<td>2.772</td>
<td>5370</td>
<td>4696</td>
</tr>
<tr>
<td>1996</td>
<td>2091.42</td>
<td>3686</td>
<td>37532395</td>
<td>2.998</td>
<td>6764</td>
<td>5415</td>
</tr>
<tr>
<td>1997</td>
<td>2124.13</td>
<td>3664</td>
<td>38684432</td>
<td>3.023</td>
<td>7410</td>
<td>6322</td>
</tr>
<tr>
<td>1998</td>
<td>2142.23</td>
<td>3634</td>
<td>39876941</td>
<td>3.036</td>
<td>6500</td>
<td>5602</td>
</tr>
<tr>
<td>1999</td>
<td>2145.10</td>
<td>3557</td>
<td>41067266</td>
<td>2.941</td>
<td>6500</td>
<td>6070</td>
</tr>
<tr>
<td>2000</td>
<td>2219.42</td>
<td>3696</td>
<td>42210756</td>
<td>2.746</td>
<td>10296</td>
<td>6600</td>
</tr>
<tr>
<td>2001</td>
<td>2268.29</td>
<td>3724</td>
<td>43295660</td>
<td>2.538</td>
<td>11412</td>
<td>6916</td>
</tr>
<tr>
<td>2002</td>
<td>2407.45</td>
<td>3444</td>
<td>44339692</td>
<td>2.383</td>
<td>12068</td>
<td>7321</td>
</tr>
<tr>
<td>2003</td>
<td>2548.03</td>
<td>3743</td>
<td>45356387</td>
<td>2.267</td>
<td>15773</td>
<td>7869</td>
</tr>
<tr>
<td>2004</td>
<td>2646.73</td>
<td>4001</td>
<td>46368386</td>
<td>2.207</td>
<td>16139</td>
<td>8682</td>
</tr>
<tr>
<td>2005</td>
<td>2737.11</td>
<td>4139</td>
<td>47393548</td>
<td>2.187</td>
<td>17386</td>
<td>9404</td>
</tr>
<tr>
<td>2006</td>
<td>2864.78</td>
<td>4028</td>
<td>48433711</td>
<td>2.171</td>
<td>16276</td>
<td>9789</td>
</tr>
<tr>
<td>2007</td>
<td>3053.12</td>
<td>3912</td>
<td>49450701</td>
<td>2.078</td>
<td>21191</td>
<td>10051</td>
</tr>
<tr>
<td>2008</td>
<td>3034.84</td>
<td>4050</td>
<td>50468799</td>
<td>2.038</td>
<td>16517</td>
<td>9964</td>
</tr>
<tr>
<td>2009</td>
<td>3116.58</td>
<td>4037</td>
<td>51513162</td>
<td>2.048</td>
<td>19535</td>
<td>10908</td>
</tr>
<tr>
<td>2010</td>
<td>3259.40</td>
<td>4080</td>
<td>52589754</td>
<td>2.068</td>
<td>21720</td>
<td>11995</td>
</tr>
<tr>
<td>2011</td>
<td>3314.36</td>
<td>4054</td>
<td>53702091</td>
<td>2.093</td>
<td>23268</td>
<td>13197</td>
</tr>
<tr>
<td>2012</td>
<td>3369.12</td>
<td>3387</td>
<td>54849058</td>
<td>2.113</td>
<td>20199</td>
<td>14463</td>
</tr>
<tr>
<td>2013</td>
<td>3131.80</td>
<td>3113</td>
<td>56009792</td>
<td>2.094</td>
<td>18592</td>
<td>15422</td>
</tr>
<tr>
<td>2014</td>
<td>3488.00</td>
<td>3471</td>
<td>56812925</td>
<td>1.900</td>
<td>21670</td>
<td>15946</td>
</tr>
</tbody>
</table>

One of the main descriptions in statistics is defining the correlation and the relation between two variables. In general, the intensity of dependency of two variables with each other is called correlation and there is a possibility that in addition to dependency intensity the researcher may also need to be informed of correlation direction. In statistics there are a number of various correlation coefficients that each measures the rate of correlation between two variables taking into accounts the type of data and the conditions of variables. In general correlation coefficient varies from -1 to 1; the relation between two variables can either be positive or negative. There is some significance in correlation coefficient that must be mentioned. Correlation coefficient is a symmetrical relationship, the more the correlation coefficient proximate one the higher rate of variable dependency. However, it should be observed that this dependency is not to the significance of cause and effect and correlation coefficient does not definitely mean cause and effect. However, if other variables effect the dependent variable then there is a probability that each covariance shares an independent variable and have effect on correlation coefficient with independent variable. Generally, in correlation coefficient this can be studied for the existence of nonlinear relation between two correlated variables while correlation coefficient shows this inaccurately.

From among correlation coefficient types, Pearson’s, based on covariance of two variables and their standard deviation was applied for this research to evaluate and calculate in accordance with Pearson correlation coefficient.

\[
P = \frac{\text{COV}(x, y)}{\sigma_x \sigma_y}
\]

In this section, initially the issue is studied to discover the effect of changes on independent variables over changes on dependent variables; in order to perform the investigations, the data in Table 3 were categorized such that each column belong to one variable. Next, independent variables correlation was compared with dependent variables. The following Table represents the corresponding values of correlation (C) and P-value (P):

### Table 3. The Effect of Independent Variable Changes Over Dependent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response 1</th>
<th>Response 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>Steel Consumption</td>
<td>0.9042</td>
<td>0.0000</td>
<td>0.9005</td>
</tr>
</tbody>
</table>
**Discussion & Conclusion Analysis**

The inputs of neural network used in this research are shown in table 4. It is important that in this study using available data and the considerations of time series for each target variable, the rate of produced energy for the current year and the previous year were also added to select inputs in the previous section.

<table>
<thead>
<tr>
<th>Steel Production</th>
<th>GDP per capita</th>
<th>Urban population growth</th>
<th>Crude Oil Production</th>
<th>Urban population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input 1</td>
<td>Input 2</td>
<td>Input 3</td>
<td>Input 4</td>
<td>Output</td>
</tr>
<tr>
<td>0.9776</td>
<td>0.0000</td>
<td>0.9780</td>
<td>0.0000</td>
<td>0.9809</td>
</tr>
<tr>
<td>0.9763</td>
<td>0.0000</td>
<td>0.9721</td>
<td>0.0000</td>
<td>0.9769</td>
</tr>
<tr>
<td>-0.8554</td>
<td>0.0000</td>
<td>-0.8620</td>
<td>0.0000</td>
<td>-0.8591</td>
</tr>
<tr>
<td>0.0017</td>
<td>0.9942</td>
<td>0.0028</td>
<td>0.9906</td>
<td>-0.0046</td>
</tr>
<tr>
<td>0.9806</td>
<td>0.0000</td>
<td>0.9680</td>
<td>0.0000</td>
<td>0.9807</td>
</tr>
</tbody>
</table>

The number of input nodes and also the neural network output can be determined via offered network mapping. In this research since there are seven independent variables and one dependent variable, the number of nodes in the input layer is 7 and the number of nodes in the output layer is one. However, a suitable method to determine the numbers of hidden layers and nodes in each layer and also the type of transfer function is use of trial and error; such that if the numbers of hidden layers and neurons of each layer are insufficient the network will not present right optimal converge solution and if the numbers are more than what required, the network becomes unstable.

In this article, in order to design the best network, several plans were examined. The results show that four layer network which two layers are hidden gives the better solution. In the network ten nodes in the first hidden layer and 5 nodes in the second hidden layer were used. In the network plan the arrangement of 7-10-5-1 was used to reach the lowest MSE. Also, different types of conversion functions were examined with various layers and the conversion of hyperbolic tangent function for various layers was attained as the better solution. The neural network developed in this study was used to find the pattern of relation between data set for different power generation methods. Figures 4(a1, a2, b1, b2) show the pattern for heater power generation method. Figure 4(a1) shows the time series of network attained from the train data and the train net; And Figure 4(b1) shows the test data and test net for response1 respectively. The figures show that there is a near correlation between train data and train net. Also, Figure 4(a2) shows the scatter plot of train data and train net omitting the time dimension; And Figure 4(b2) shows the same comparison between the test data and test net. The same method was used for other electricity power generation methods in Iran.
FIG. 4 - DEMONSTRATION OF TEST & TRAINING DATA PROCESS AND HEATER POWER GENERATION METHOD

In Figure 5 a survey on test & training data collection for establishing neural network (ANN) is presented. In designing this information network, the total national power generation is utilized and Figure 8b shows the combination of all data for different power generation methods.

FIG. 5 - DEMONSTRATION OF TEST & TRAINING DATA PROCESS FOR ALL METHODS OF POWER GENERATION IN IRAN
In all prediction methods the error and the uncertainty is unavoidable. Therefore, to establish a predicted model and select the best model among various existing ones in a time series an index is required to find the certainty of acceptance or rejection of adopted predicted model. In general, the more proximity of actual series \( y_t \) to predicted value \( \hat{y}^t \) shows the more model accuracy. Therefore, the quality of a model is evaluated on the basis of predicted error as follows:

\[
e_t = \hat{y}_t - y_t
\]

Prediction error is caused by ignore of one or more components of time series predictions like trend, seasonal and cyclical effects. Also, the error could be due to irregular and erratic fluctuations in data source. In this case, total errors that can be observed by a prediction method is determined as follows:

\[
SE = \sum_{i=1}^{n} [y_i - \hat{y}_i]
\]

where \( n \) is the number of observed duration.

This error can be determined in a different method using the mean squared error (MSE) as follows:

\[
MSE = \frac{\sum_{i=1}^{n} [y_i - \hat{y}_i]}{n}
\]

In Table 5 the obtained MSE for each test and training data is demonstrated. It is worth mentioning that test and training dataset is randomly selected thus data set 3, 7 and 17 are selected as data test and the rest are considered as training data. Results in Table 5 shows that the determined error using the test data is acceptable.

**TABLE 5 – MSE VALUES OBTAINED FROM TEST AND TRAINING DATA**

<table>
<thead>
<tr>
<th>Method</th>
<th>Train MSE</th>
<th>Test MSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response 1</td>
<td>7.6028e-05</td>
<td>0.0029</td>
</tr>
<tr>
<td>Response 2</td>
<td>9.7939e-05</td>
<td>0.0023</td>
</tr>
<tr>
<td>Total</td>
<td>9.6952e-04</td>
<td>0.0086</td>
</tr>
</tbody>
</table>

Using the network designed in this study and based on real data collected in 18 years, the feasibility of the types of energy production and the rate of production for the coming year is anticipated. Table 6 indicates the predicted values for the generation methods of electricity in Iran in 2015.

**TABLE 6. PREDICTED VALUES OF 2014 FOR ELECTRICITY GENERATION METHODS (Kw).**

<table>
<thead>
<tr>
<th>Method</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response 1</td>
<td>60148.3031</td>
</tr>
<tr>
<td>Response 2</td>
<td>11696.8009</td>
</tr>
<tr>
<td>Total</td>
<td>72826.0896</td>
</tr>
</tbody>
</table>

As in the methodology used was explained, for predicting the energy producing with various methods in 2025, data pattern should be assumed steady i.e. without a significant change up to 2025. Therefore, a proper regression method can be used to estimate the input data for neural network.

It must be noted that when an equation is solely used for predictions there may not necessary to have a cause and effect relation. In this case, it is required to have the reliable data relevance to use a proper regression model. The followings methods are used as the Multi-purpose regression models:

- Data description
- Evaluation of parameters
- Prediction & estimation
- Control

Therefore, it is probable to use the regression models for controlling. However, when a regression equation is applied to control an objective, the variables should be randomly related. In this research the following regression method which is a polynomial model is used to appraise the required inputs for forecasting the data for year 2025. Coefficient of each relevant equation is given in Table 7.

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\[ f(x) = b_0 + b_1 \times x + b_2 \times x^2 \]

**Table 7. Coefficient for Each Equation**

<table>
<thead>
<tr>
<th>Method</th>
<th>(b_0)</th>
<th>(b_1)</th>
<th>(b_2)</th>
<th>(R)-square</th>
<th>Adjusted (R)-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response 1</td>
<td>17180</td>
<td>870.6</td>
<td>72.75</td>
<td>0.9912</td>
<td>0.9901</td>
</tr>
<tr>
<td>Response 2</td>
<td>1156</td>
<td>159.7</td>
<td>19.91</td>
<td>0.9746</td>
<td>0.9716</td>
</tr>
<tr>
<td>Total</td>
<td>18400</td>
<td>1017</td>
<td>94.18</td>
<td>0.9933</td>
<td>0.9926</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>1833</td>
<td>81.34</td>
<td>0.06988</td>
<td>0.9608</td>
<td>0.9662</td>
</tr>
<tr>
<td>Steel Consumption</td>
<td>2084</td>
<td>1690</td>
<td>-35.53</td>
<td>0.9129</td>
<td>0.9027</td>
</tr>
<tr>
<td>Steel Production</td>
<td>5257</td>
<td>47.29</td>
<td>25.29</td>
<td>0.9843</td>
<td>0.9825</td>
</tr>
<tr>
<td>Urban population Growth</td>
<td>3.24</td>
<td>-0.1225</td>
<td>0.003002</td>
<td>0.8777</td>
<td>0.8633</td>
</tr>
<tr>
<td>Urban population</td>
<td>35400000</td>
<td>1123000</td>
<td>-2637</td>
<td>0.9997</td>
<td>0.9997</td>
</tr>
</tbody>
</table>

In this study the coefficient of determination, denoted \(R\) squared, is used to indicate how well the input data are fitted to the introduced statistical model. Table 7 shows that the regression models in this study are accurate because the \(R\)-squares and Adjust \(R\)-squares determined are higher than 0.87 and 0.85 relatively.

Figures 6 (a-e) and 7 (a-e) clearly show the fitness of data and curves obtained from regression equations are fairly adequate.

**Fig. 6** – Regression equation for effective variables on power generation process (A) Steel Consumption (B) Steel Production (C) GDP per capita (D) Urban Population growth (E) Urban Population

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FIG. 7 – REGRESSION EQUATION FOR VARIOUS POWER GENERATION METHODS (A) RESPONSE 1 (B) RESPONSE 2 (C) TOTAL
Using the inputs obtained from regression models, the electricity generations between 2015 and 2025 are estimated by the developed neural network. The results of power generation methods in the predicted decade are presented in Table 8.

<table>
<thead>
<tr>
<th>Method</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response 1</td>
<td>103022.546</td>
</tr>
<tr>
<td>Response 2</td>
<td>22531.604</td>
</tr>
<tr>
<td>Total</td>
<td>128584.462</td>
</tr>
</tbody>
</table>

Since Iran is an arid country with low precipitation, the increase of hydropower electricity is not probable. Also, past experiences and prolongation of nuclear power plant operation in Iran (34 years) state that increase of power generation using the atomic method during the following decade is not easily feasible. Also, the presented information by the Iran Ministry of Energy [23] states that during 1967 – 2014 capacity of power generations using renewable methods (non-atomic) limited to 193 MW. Consequently, it is anticipated that within the next future decade the tendency to develop the power generation in Iran using the renewable resources is still constrained because the fossil energy in Iran is quiet cheap.

Thereupon, the share of production increase in hydropower sectors and the two other methods of gas and steam turbines are subdivided. In consideration of the fact that by looking at Table 8 the ratio of heater to gaseous is 0.2290 and also since it is assumed that the rate of hydropower and other methods will remain stable, Table 9 in respect to power generation anticipation will be then replaced to Table 8.

<table>
<thead>
<tr>
<th>Method</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response 1</td>
<td>113769.150</td>
</tr>
<tr>
<td>Response 2</td>
<td>11785</td>
</tr>
<tr>
<td>Total</td>
<td>128584.462</td>
</tr>
</tbody>
</table>

TABLE 8. THE ELECTRICITY GENERATION PREDICTED IN 2025 USING THE DEVELOPED NEURAL NETWORK (KW).

Nowadays Iran is producing the electricity using different resources i.e. gaseous, steam, nuclear and renewable resources. However, the low price of fossil fuel in Iran and the time consuming of some power plant constructing affect the outcome of investment in future of power plan in the country in the remaining time of vision documentary. On the words, it seems that fossil fuel is inexpensive and highly in access in Iran. This may have developed the urge of investment on Iran power generation using oil and gas; the said sole 0.1% of total national capacity was generated using various methods like solar energy, wind energy and geothermal [15]. That is why the present study endeavors to estimate the required costs of investment on power industry principally on the basis of fossil fuels.

Needed Estimated Investment to Generate Electricity
Based on estimated prices in [19, 20] for electricity generation, the require investment for various methods per kilowatt is demonstrated in Table 10.

<table>
<thead>
<tr>
<th>Method</th>
<th>Response 1</th>
<th>Response 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>29.4150</td>
<td>18.65</td>
</tr>
</tbody>
</table>

Using Tables 9 & 10 the total investment for electricity generation in Iran 2025 is estimated as shown in Table 11.

<table>
<thead>
<tr>
<th>Method</th>
<th>Response 1</th>
<th>Response 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3346519.547</td>
<td>219790.25</td>
</tr>
</tbody>
</table>

Using results in Tables 6 & 9 the average rate of electricity production is calculated in each method. The annual average for the steam method is equivalent to 20804.776 kilowatt electricity, for the gaseous method is 56397.094 kilowatt, for the hydropower method is 10231.668 kilowatt and for other methods is 17926.75 kilowatts. Using Table 10 the required average investment for power generation can be calculated for various methods. The average required investment for power generation by the steam method is 444390.02, by the gaseous method is 2113199.1, by the hydropower method is 64766.458 and by other methods is about 334333.88 hence, it can be concluded that the total required investment until 2025 for power generation in Iran is equal to 32526411.48 US Dollar.
CONCLUSION

Economy of Iran is growing due to the young and educated people who want to use and enhance the great potentials of mining and industries of Iran. Therefore, Iran is going to increase generation capacity of electricity, and this issue depends highly on extensive investments in this term. In the absence of necessary investment, the country must resort to energy import or otherwise Iran will face to a large-scale blackout. In view of the fact that most neighboring countries are politically unstable and insecure, the energy import is not reliable for the future decade in terms of industry, agriculture and household use. Therefore, this survey, by application of developed methodology, is aimed to determine the required investment in electricity generation in Iran. Therefore, initially the effective factors of Iran power generation were identified based on the rate of dependency to target variable factors. These factors are GDP per capita, urban population (as the main electricity consumer), urban population growth (as the stimulus of consumption), steel consumption (as the factor of development) and steel production (as the main electricity consumer)

A neural network was used combining with a regression method. The considered inputs in designing the neural network were prepared using the identified factors and trends of electricity production data during the last 18 years in Iran. The developed neural network in this study combining with the regression equations predicts the power generation for year 2025 as the vision of Iran. The past overview of investment in Iran electricity industry demonstrates the analysis of national power generation. Based on this analysis the generation of electricity using the atomic energy in the next decade is not feasible because ten years is not adequate to construct a new atomic power plant. In addition, other renewable sources of energies in Iran are not actually economic because fossil fuels are fairly cheap in Iran. Hence, investment process of coming decade is tended to gas and steam power generation in electricity industry. Therefore, the investment equivalent to 32526411.48 US $ must be considered by Iran’s government in the power plant for the next decade.

REFERENCE

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SEXUAL ASSERTIVENESS AMONG FEMALE COMMERCIAL SEX WORKERS

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Abstract: INTRODUCTION- Sexual assertiveness begins with acquiring the knowledge of what is appropriate and inappropriate sexual behavior. From early years, we were most likely taught “good touch” and “bad touch” to differentiate the handling of sexual from nonsexual parts of the body. Jenkins writes that sexual assertiveness empowers women and men alike to be active in what happens to their bodies where sexuality is concerned. OBJECTIVES (1) to estimate level of Sexual Assertiveness among female commercial sex workers 2) To associate the sexual assertiveness with their selected demographic variables.

MATERIALS &METHODS: Mixed Method study was done among 30 FSW to explore the Sexual Assertiveness by using sexual assertiveness scale (Quantitative) in-depth interview (Qualitative). Level of sexual assertiveness was assessed by sexual assertiveness scale developed by Dr. Patricia J. Morokoff , following that indepth interview were done in 7 sex workers.

RESULTS: The computed result shows that majority of FSW (56.7%) has inadequate sexual assertiveness and there is a significant association (0.05 %) between their marital status and number of dependents but their age and education doesn’t play any significant role in their assertiveness.

CONCLUSIONS: The result shown that there is a less sexual assertiveness among Female Sex Workers, they were compromised themselves for not using condom during the sexual act. No woman could choose to be in sex work and making money but social and economic factors paved the way towards sex work. Provision of economic safety of female sex workers reduces the condom negotiation thus decrease the chance of HIV transmission.

RECOMMENDATIONS (1) Promote Job opportunities for Female Sex Workers (FSW)(2) Rescue them and restore them in good income source (3) Encourage sex communication in married couples to share their own sexual need between them to avoid search of sexual act outside of marriage ties and indulge in unprotected sexual intercourse. (4) Create intensive condom awareness among both Genders, and consistent condom use. (5) Encourage women empowerment(6) Improve the status of women in society, promote Gender equality. (7) Increase self-confidence and strength of women in society.

Keywords: Sex, Female Sex workers, sexual assertiveness, condom, mixed method

I. INTRODUCTION

World Health Organization South-East Asia Regional Office, (1994) New Delhi, stated that HIV was introduced in India much later than in other parts of the world, but is spreading with unprecedented rapidity and is becoming a public health problem with enormous social and economic implications. HIV in India is spread mainly through heterosexual intercourse, moving from high-risk behavior populations to the general population.

There are more than one million prostitutes aged under 16 in eight Asian countries with 4, 00,000 in India. The group of people most at risk of HIV /AIDS was women, young people and sex workers. Most people become sex workers so they can feed, clothe, and supply the basic needs for themselves and their families and they were abandoned wives, mothers with no means of support and poverty strikes people. (International news 2000).

Sexually active unmarried young people 15- 24 yrs old, those indulging in extra marital sex, and those addicted to opium / poppy husk were observed to be at higher risk of HIV infections. (Benjamin et al. 2007).

HIV positive women were significantly more likely to report marital dissatisfaction, a history of forced sex, domestic violence, and depressive symptoms and husband’s extra marital sex when compared to the HIV negative women (Gupta RN et al., 2008)In West Bengal among 558 brothel based sex workers explored that HIV infection was much higher (15.5%) in younger sex workers (age < or = 20 years), compared with old age groups 5.4%. This could be associated with larger areas of cervical ectopy of younger sex workers who are subjected to repeated trauma during sexual intercourse, facilitating higher HIV transmission. Behavioral factors may increase a young sex workers risk of acquiring HIV infection including professional immaturity with clients which might lead to unprotected sex. (Sarkar B et al 2006)

In Pune among 1359 FSW the overall HIV prevalence was 54 % and not being married, being widow, inconsistent condom use, and clinical presence of genital ulcer disease were associated with HIV infection among them.
NEED FOR THE STUDY

Sexual assertiveness begins with acquiring the knowledge of what is appropriate and inappropriate sexual behavior. From early years, we were most likely taught “good touch” and “bad touch” to differentiate the handling of sexual from nonsexual parts of the body. (Latoya Newman) Young people are often found to be resilient despite adverse environments and experiences. Protective factors (social support, community connection, and self-esteem) can encourage resiliency (Dr. Erin Wilson 2008).

The Power to Say No

Being aware of our rights not to be mentally, physically or emotionally abused by anyone gives more power to assert those rights. do not have to engage in any sexual activity unless want to, such as kissing, intimate touching or further sexual activity. If feel uncomfortable in an intimate situation or are not ready to become involved in any sexual activity then there is a right to say no, directly or indirectly through your words or body language, and to have these wishes respected.

Protect Yourself from Risk

If and when do decide to become sexually active, we will be able to make the appropriate choices in methods to protect our self from unwanted pregnancy and sexually transmitted diseases.

Enjoy Healthy Sexual Development

With maturity and growth, individuals who are sexually assertive can feel comfortable in expressing their desires and needs within their intimate relationships. We have the right to develop a healthy sexual identity so that we can be free from guilt and discontent in our choices and decisions. A Study of Sexual Assertiveness Characteristics, Jenkins writes that sexual assertiveness empowers women and men alike to be active in what happens to their bodies where sexuality is concerned.

Powell’s said that like other habits, it may need to repeat them and practice them over and over until they become second nature—or at least easier. Further Dr.Powells stated Understand sexual rights is to refuse any type of sexual contact, regardless of how aroused the partners might be .Consistent and correct use of condoms coupled with risk reduction strategies continue to play an important role in the reduction and prevention of HIV/AIDS transmission therefore understanding and incorporating strategies to overcome barriers to condom use in such education and prevention efforts are critical. (Roth J 2001)

II. OBJECTIVES

Aim: To estimate level of Sexual Assertiveness among female commercial sex workers in Chennai district.

The study was intended
1. To estimate level of Sexual Assertiveness among female commercial sex workers.
2. To associate the sexual assertiveness with their selected demographic variables.

Research Hypothesis

The study was descriptive in nature and there for not meant to test the experimental hypothesis, but it was with the following research questions.

1. Is there an any sexual assertiveness among female commercial sex workers?
2. Will adequate sexual assertiveness reduce the chance of being infective with HIV?

III. MATERIALS AND METHOD

In this study, a Mixed Method research approach was used to explore the Sexual Assertiveness among female commercial sex workers in Chennai district, Tamilnadu by using sexual assertiveness scale (Quantitative) in-depth interview (Qualitative)

IV SAMPLE

The study was done in conveniently chosen 30 female sex workers with the following criteria.

Inclusion Criteria
1. Women aged < > 18-45 years indulge in sex for money at least for past 1 year.
2. Females Sex Workers who are resident of Chennai district, since for last 5 years.
3. Females Sex Workers willing to participate.
Exclusion Criteria

1. Migrated Females Sex Workers from other countries.
2. HIV Diagnosed Females Sex Workers.
3. Females Sex Workers suffering from any chronic physical illness, or mental illness.

V. INSTRUMENT

Instrument consists of 3 sections

Section 1: Baseline Data

Section 2: 5-point scale on Sexual Assertiveness.

Section 3: in-depth interview to derive themes

VI. DATA COLLECTION PROCEDURE

The study was carried out after obtaining Institutional Ethics committee clearance, and formal permission obtained from ICWO. Brief introduction about study was given and informed consent had obtained from female sex workers for assurance of participation. Confidentiality of their response was maintained. 30 FSW were selected from ICWO referred Brothel Homes by Convenience sampling technique. Level of sexual assertiveness was assessed by sexual assertiveness scale developed by Dr. Patricia J. Morokoff, PhD Associate Dean, University of Rhode Island. The FSW were informed about statements represent their assertiveness in sexual activity, and instructed to circle one of the five response categories that best describes their status in Never, Sometimes, Half time, Usually and Always. Instrument took 10 Minutes to complete. In depth interview was done among 7 of FSW, interviews probed reasons of clients for sex reasons situations entering in to sex preventive measures taken to avoid childre

VII. RESULTS

Section- A: Base line data of Female Sex Workers.

Table-1 Baseline Data of FSW

<table>
<thead>
<tr>
<th>S. No</th>
<th>Demographic Data</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-25 Yrs</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>26-30 Yrs</td>
<td>10</td>
<td>33.33%</td>
</tr>
<tr>
<td></td>
<td>31-35 Yrs</td>
<td>10</td>
<td>33.33%</td>
</tr>
<tr>
<td></td>
<td>36-40 Yrs</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>41-45 Yrs</td>
<td>4</td>
<td>13.33%</td>
</tr>
<tr>
<td>2</td>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>illiterate</td>
<td>4</td>
<td>13.33%</td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>18</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>Higher Secondary</td>
<td>4</td>
<td>13.33%</td>
</tr>
<tr>
<td></td>
<td>Graduate</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>4</td>
<td>13.33%</td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>18</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>Separated</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Divorced</td>
<td>8</td>
<td>26.66%</td>
</tr>
<tr>
<td>4</td>
<td>No. of Children</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>10</td>
<td>33.33%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>17</td>
<td>56.66%</td>
</tr>
<tr>
<td>5</td>
<td>No. of Dependents</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>6</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>8</td>
<td>26.66%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10</td>
<td>33.33%</td>
</tr>
</tbody>
</table>
Table-1 Shows most of the sex workers were in the age of 25-35 Yrs (66.65%) and completed primary class (60%) of education.

<table>
<thead>
<tr>
<th>No. of Days of Sex Work / Week</th>
<th>3</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>50%</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>33.33%</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>6.66%</td>
</tr>
</tbody>
</table>

Table-2 Data shows majority of FSW (56.7%) has inadequate sexual assertiveness.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Level of sexual assertiveness</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Inadequate</td>
<td>17</td>
<td>56.67%</td>
</tr>
<tr>
<td>2.</td>
<td>Moderately adequate</td>
<td>13</td>
<td>43.33%</td>
</tr>
<tr>
<td>3.</td>
<td>Adequate</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Figure 1 Age

Figure 2 Education Status

Section: B level of sexual assertiveness among FSW

Table-2 level of sexual assertiveness among FSW

<table>
<thead>
<tr>
<th>S.No</th>
<th>Level of sexual assertiveness</th>
<th>Number</th>
<th>Percentage</th>
<th>statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Inadequate</td>
<td>17</td>
<td>56.67%</td>
<td>Mean=46.06 SD-11 Median-50 Skewness = -0.23</td>
</tr>
<tr>
<td>2.</td>
<td>Moderately adequate</td>
<td>13</td>
<td>43.33%</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Adequate</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>
Table-3 Association of assertiveness and demographic variables

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Demographic Data</th>
<th>Adequate</th>
<th>Moderately adequate</th>
<th>Adequate</th>
<th>Chi-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td>P value-0.165. NS at 0.05 level</td>
</tr>
<tr>
<td></td>
<td>20-25 Yrs</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>26-30 Yrs</td>
<td>3</td>
<td>7</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31-35 Yrs</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36-40 Yrs</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Educational Qualification</td>
<td></td>
<td></td>
<td></td>
<td>P value-1 NS At 0.05 level</td>
</tr>
<tr>
<td></td>
<td>Illiterate</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primary Class</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Higher secondary</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
<td>P value-0.00367 significant At 0.05 level</td>
</tr>
<tr>
<td></td>
<td>Unmarried</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>12</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Divorced</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>widow</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>No of dependents</td>
<td></td>
<td></td>
<td></td>
<td>P value-0.00547 Significant At 0.05 level</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Table: 3 shows there is significant association (0.05 %) between their marital status and number of dependents but their age and education has no significant association in their assertiveness.

**VIILDICUSION**

This chapter discusses the findings of the study derived from the statistical analysis and its pertinence to the objectives of the study. This study was conducted to estimate level of assertiveness among female sex workers (FSW)

**Estimation of level of assertiveness among FSW**

The computed result in table 2 shows that majority of FSW (56.7%) has inadequate sexual assertiveness and they are compromise themselves in using condom during sexual intercourse with their clients
Association of sexual assertiveness and demographic variables.

Table: 3 shows there is a significant association (0.05 %) between their marital status and number of dependents but their age and education doesn’t play any significant role in their assertiveness

After interview and probing 4 key themes was derived the themes were as follows:

**Theme: 1 Reasons for clients coming for sex**

The FSW revealed that the following reasons their clients were approaching for sex.

a. Personal factors

oral sex, needs more pleasure, sex in different position, divorce status different sex, need sex with younger woman than wife, need relaxation, unfaithful wife, wants to have sex with alcohol, wants to have sex with physical features like big breast, big hip.

b. Social factors

Wife’s pregnancy, ill health, delivery of baby, medical illness, lack of privacy at home for sex, having older children at home no space for sex,

**Theme: 2 Reason for entering in Sex Work**

Female sex workers said that their economic need pulled them to indulge in sex activity; the conditions were destitute status, drunken husband, irresponsible husband, education for children, and no source of getting money and they found sex work is a easy way to generate money in short period and they also enjoying independency in working days.

**Theme: 3 Preventive measures taken to avoid their own children entering into sex work.**

FSW were chosen sex work voluntarily but uninterestedly because of their economic conditions to lead life. They don’t like their Children to follow their footsteps in Job and not to make them aware of their work, thus they kept their children far from them like admitting them at hostel or with grandmother at native place if the children are very small age they are with them till children grew older

**Negotiating factors of condom use.**

Since money (double payment) play a major role in negotiating condom usage but other factors also equally played role like alcohol, clients disagreement, fear of losing clients, lack of time, quickness, urgency in compromising condom usage during sexual act.NGO are playing major role in creating awareness on condom and HIV/AIDS among them but in certain factors they are compromising themselves or they were forced by sexual partners in not using condom during sexual intercourse.

**IX. CONCLUSION**

The result shown that there is a less sexual assertiveness among Female Sex Workers, they were compromised themselves for not using condom during the sexual act. No woman could choose to be in sex work and making money but social and economic factors paved the way towards sex work. Provision of economic safety of female sex workers reduces the condom negotiation thus decrease the chance of HIV transmission.

**X. RECOMMENDATIONS**

1. Promote Job opportunities for Female Sex Workers(FSW)
2. Rescue them and restore them in good income source.
3. Encourage sex communication in married couples to share their own sexual need between them to avoid search of sexual act outside of marriage ties and indulge in unprotected sexual intercourse.
4. Create intensive condom awareness among both Genders, and consistent condom use.
5. Encourage women empowerment
6. Improve the status of women in society, promotes Gender equality.
7. Increase self confidence and strength of women in society.
ACKNOWLEDGEMENT

Researchers extend her sincere thanks to Dr. Patricia J. Morokoff, PhD Associate Dean, College of Arts and Sciences, University of Rhode Island, for valuable suggestion, guidance and help in development of tool, and also ICWO (NGO) for helping in reaching Female sex workers for study.

REFERENCES

2. Guidelines for Antiretroviral therapy for HIV – infected Adults and Adolescents; March 2007; NACO
3. Rodrigues jj, mehondalesm, shaphared ME civekar AP Gangakhedkar RR, Quinn TC at all risk factors for HIV infections in people attending clinics for STD
5. Asha Krishna kumar Front line .The Hindu publishers, Volume 21 - Issue 14, Jul. 03 - 16, 2004
9. Tiffany field 2003 “HIV Positive and Adolescents”
The influence of top management support on the extent of PMIS uptake in disaster management projects in fire stations in Kenya

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Abstract: Technology adoption in most sectors is usually pegged on how the top management supports the adoption process. In disaster management technology is steadily playing a key role in ensuring there is high standards of implementation of disaster management projects and that the top management continuously being blamed for the low levels of technology uptake as experienced and confirmed by various authors and reports from various fire stations. This study looks into the factors of top management support that are considered to greatly influence the levels of uptake of Project Management Information Systems (PMIS) in disaster management projects at the fire stations in Kenya. The study specifically looked into the influence of perceived PMIS usefulness, Key-Staff involvement, and communication as the core factors related to top management support. A review of relevant literature revealed that top management to a significant level have an influence on the level of PMIS uptake and the study applying mixed method approach and concurrent design to the study came up with candid findings. From the findings it was concluded that the top management factors have a significant influence on the level of uptake of PMIS in fire stations and recommends that both the station managers and policy makers should consider abridging these factors so that they are in line with the immediate needs of the fire station in terms of PMIS adoption and improvements and that policies should be developed that encourages high levels of PMIS uptake supported by the top level management.

Key Words: Project Management Information Systems; Disaster Management Projects; Top Management Support; Technology Adoption; Fire Stations.

INTRODUCTION

The global rise in disasters whether natural, human-induced and technological is high and continuing according to the World Disaster Report (2004:161) as reported by IFRC (2010). From 1994 to 1998 the reported major disasters averaged 428 per year and from the year 1999 to 2003, the figures rose up by two thirds to an average of 707 disasters per year and the biggest increase was in development countries like Kenya where the increase
was reported at 142 per cent (IFRC, 2010). This increase has raised international concerns on the Fire Stations disaster preparedness and their abilities to quickly respond to disasters in order to limit their impact on the population. Failure to adequately use technologies in disaster management departments in a timely manner may results in increased number of causalities (IFRC, 2010). According to US congressional investigation on Hurricane Katrina that hit the southern US coast in 2005, the federal, state and city agencies did not plan and allocate the resources using the available Project Management Information System (PMIS) adequately to ensure decisive response actions. It was also noted that many disaster management procedures and plans generated by the PMIS for disaster management were improperly implemented. Despite the shortcomings, PMIS have gained much attention globally for their applications in resource allocation and are increasingly being utilized throughout the disaster management cycle as a tool to support decision making. PMIS tools have been recognized as a key support tool for disaster management (Mileti, 1999). The reporting capabilities of these systems have almost become synonymous with policy makers, disaster managers and the general public. PMBOK (2004) define PMIS as the coherent organization of the information required for an organization to execute projects successfully and is usually typically one or more software applications and a methodological process for collecting and using project information to help plan, execute and close project management goals.

Mintzberg (1983) theorizes therefore that most of the emergent organization including fire stations, since the second world war are projects intensive and that the widespread use of projects in these fire stations demands an approach that can efficiently manage the temporary endeavours which are critical to the fire stations strategic objectives. In 1980s, the use of automated data processing and later new techniques were developed to influence better investment implementation (PMBOK, 2004). The concept of management of projects and management by projects clearly, according to Soderlund (2004), points to the requirement of PMIS as a candid tool and its uptake by fire stations would certainly determine the level of success of these projects. Most countries in the Eastern Africa region are categorized by the United Nations Development Program (UNDP, 2013) as category of low human development. Although Kenya is best ranked among the East African countries at 145 out of 186 countries of which data is available, disaster emergencies will still erode the development gains. The East African region is prone to both natural and man-made disasters hence important considerations should be made on the preparedness of its fire stations in utilization of technologies like PMIS in managing disasters during the pre- and post- occurrence of these disasters. According ISDR (2013) the disaster scenarios, across the region, ranges from civil strife, population movement, terror attacks, earth tremors, cyclones, flooding, droughts and epidemics with various countries exhibiting varying degrees of exposure. Of importance is fire related emergencies which makes up to 60% of disasters experienced in the region (Chatora, 2005). Disaster response to these situations in the region often becomes desperate due to the inadequate state of disaster management...
resources coupled with poor planning, allocation and lack of support within the governments to inadequate preparedness; insufficient contingencies; delays in emergency response; inadequate and uncoordinated information flow; poor institutional arrangements; and inadequate systems and procedures for emergency risk management (Chatora, 2005). In Kenya lessons learnt from the fire disasters which includes Nakumatt fire on 28 January 2009 which had 29 fatalities with 47 reported missing, the Nairobi pipeline fire on 12 September 2011 with 100 fatalities and 116 other hospitalized with varying degrees of burns, and the most recent Jomo Kenya International Airport (JKIA) fire on August 2014 which had no fatalities but resulted in losses estimated at Kshs.300 million according to the Kenya Airport Authority status report (2014), have all shown the level of lack of preparedness and insufficient and ineffective application of technologies like PMIS in planning and allocation of emergency management resources (IFRC, 2014). As a result of the recent disasters there have been increased activities in contingency planning, provision of early warning systems to the fire stations and increased preparedness through hiring of more fire station service men and women however the impact was minimal according IFRC (2014) as it did not take into consideration the extent of management information system (MIS) technologies role.

**Emergency Management Theory**

Formulated by Drabek (2005) emergency management theory provides impetus to the study of factors of adoption of technology such as PMIS in disaster management projects. According to Drabek, the theory of emergency management focuses on the top management support as the core center of operations in an institution or organization involved in disaster projects like fire stations. Scholars in the field of disaster management contend that emergency management theory well explains the role top management play in the success of a project and further asserts that the success of disaster management projects depend on the top management of the fire station which is essentially outlined by the topology of the fire station (Granito, 2014; Philip, 2014; Drabek, 2005; Raymond & Bergeron, 2008). This topology according to the scholars includes the site specific disaster project arrangements, the crisis involved, the station’s response patterns, and finally the fire stations improvisation in disaster management projects. Emergency management theory, therefore according to Drabek (2005) relates to how people create, interact and cope with hazards, risks, vulnerabilities and management support with relation to implementation.

Further Drabek (2005) notes that in order to support technology uptake in disaster management projects in fire stations, the focus should be on four structural components which are the domains, tasks, resources and the activities of the project. The domains is a function of a well-organized response while the tasks are how the domain is accomplished and the resources are the fire stations capacity availability which includes the resources
like PMIS with their modern capabilities, commodities and equipment. Activities on the other hand are the teamwork policies which are interdependent actions of fire station stakeholders in the allocation of the available resources. In order for this relationship to be bridged Njoki (2013) states that PMIS is essential in ensuring success of the disaster management project. This theory in essence provides understandings of the factors are of great importance when studying the extent of uptake of PMIS in disaster management projects in fire stations. Barney (1991) and Bissell (2005) on the other hand, contend that emergency management theory focuses on the resources and capacity availability at the fire station with respect to disaster management projects. This perspective therefore advocates that fire stations’ resources and capacity availability should be consistent with other aspects of the station which can only be managed by a technology based system like PMIS. This aspect of the theory is further proved by a number of studies such as Philip (2014) studying efficient allocation of fire department resources in California and Granito (2014) studying evolution and planning of public fire protection. Technology based innovation PMIS therefore is a necessary component in the management of disaster projects and specific to every fire station. The major criticism of this theory as suggested by McEntire (2004) is the shared nature of the subject matters with other disciplines. In essence, this theory over generalizes disaster management projects as part of other projects at the fire station. In attempting to focus on four structural components of domain, tasks, resources and the activities in supporting technology uptake, the theory assumes that the relationship between technology uptake and these components is linear and non-problematic. McEntire further contends that part of the weaknesses of this theory is the failure to provide a coherent system that merges the welter of the components in PMIS uptake that also plays a bigger role in disaster management projects at the fire stations. Top management support, capacity availability, teamwork policies and stakeholder involvement associated with these functional components of disaster management projects also plays a bigger role but the theory fails to take this into account. Kapucu and Van Wart (2006) also agrees with the deficiencies in the theory stating that it is limited by the impossibility of modelling all contingent variables considered in uptake of technology like PMIS hence the difficulties in showing how the factors which are the components influences the extent of uptake of technology adoption like PMIS. Kapucu (2009) brings to attention that a theoretical model should incorporate the role played by the other varying factors to simultaneously promote a general fit in extent of PMIS uptake in disaster management projects and cope with future projects.
Conceptual Framework

![Conceptual Framework](image)

The conceptual framework of the study was based on perceived PMIS usefulness, Key-staff involvement, and communication. This was the researchers interpretations of how the variables relate and the figure therefore implies that there exist an influence and relationship between the independent variables and the dependent variables.

Review of Related Literature

Technology adoption is a result of a decision by top management to accept a given innovation and Feder, Just and Zilberman (1985) citing work done by Roger (1962) define technology adoption and level of uptake as the top management mental process of accepting the technology from the first hearing about it to the final utilization. From this definition it is then believed that the top management interest in technology adoption and uptake falls into two categories: rate of adoption, and the intensity of adoption. Feder, Just and Zilberman define rate of adoption as the relative speed with which fire stations adoption PMIS innovation and taking into consideration the element of time. On the other hand, intensity of adoption refers the level of use of PMIS technology in any given time. Top management, according to Young and Jordan (2008), can influence the implementation and use of new technologies like PMIS by devoting their time to the technology in proportion to its costs and the potential, additionally reviewing plans, monitoring results and facilitating the management of problems that are arising during the integration of the technology to the disaster management project life cycle. Feder and Slade (1984) cited by Njoki (2013) notes that the top management support encourages technology usage, better performance, positive user perception influence, and improvement in the overall technology adoption uptake. Top management team in any fire station therefore determines the technological implementation success or failure. Furthermore, Dong et al. (2009) argue that effective top management support is one of the strongest enablers of PMIS implementation in fire stations as it is view as a clear commitment and allocation of sufficient resources to the PMIS and involvement in managing change that comes with the
technology uptake. The UTAUT model which has been touted as the model for technology adoption does not specifically measure top management support in its constructs. Neufield et al. (2007) additionally points out that the top management support as a factor in technology adoption has not been sufficiently integrated into existing user adoption theories and neither does it have literature that is specific to top management behaviours that are associated with the success in technology implementation.

Other authors have also concluded in their findings that perceived usefulness of technology has a bearing on the extent of its uptake. Lewis, Agarwal & Sambamurthy (2003) examined the simultaneous effects of influences that emanated from the individual, institutional and social context in which they interacted with information technology. Their findings suggested that beliefs about technology usefulness can be influenced by top management commitment to the new technology and the individual factors of personal innovativeness and self-efficacy further stating that social influences from multiple sources did not exhibit any significant effects. Davis, Bagozzi and Warshaw (1989) in their longitudinal study of 107 technology users concluded that perceived usefulness of technology by the top management had the possibility of guiding managerial interventions aimed at ensuring there is full uptake of technology.

A comparative study in construction industries in Nigerian however indicated that the successful completion of these projects were dependent on technological changes in project management which includes the uptake of PMIS noting that a low uptake leads to lower number of projects completed (Karodia, Cowden & Magaba, 2014). A benchmarking framework by Ahuja, Yang and Shankar (2010) revealed also that ICT including PMIS adoption by small and medium fire stations must take into consideration understanding of processes, project success indicators and measures in order to achieve high turnover in completed projects. Similarly Barki and Huff (2005) concludes that the success in the number of disaster management projects completed relies heavily on the level and extent of uptake of the technology in the project itself and indicates that the higher the level of uptake, the higher the number of projects completed as enabled by the technology. Other authors are however of the opinion that the greatest role in uptake of technology like PMIS is in top management communication in support of the technology itself. Pan and Jang (2008) in their study of 99 firms in Taiwan’s communication industry developed the technology-organization-environment (TOE) framework and concluded that communication leaning towards top management support of the technology being adopted to be of great importance. For a technology to succeed in its uptake, the top management must have a system of communicating directly with the fire stations involved and Premkumar and Roberts (2009) while analysis data collected from 78 organizations concluded that top management communication on technology uptake is vital and the form of communication used by managers includes telephone, e-mail, and
meetings. Oliveira and Martins (2011) on the other hand view technology as a universally accepted essential tool in enhancing competitiveness of the fire station and notes that a consensus must be created on the type of communication to be made by the top management in support of the technology being adopted. Further they note that the type of communication chosen by the top management is to enable in the diffusion of the PMIS in disaster project management at the fire station level.

**METHODOLOGY**

**Research Design**

According to Kothari (2004), a research design is a framework that guides the collection and analysis of the data and is a detailed plan for how research study is conducted according to data required and in the order of research questions investigations in an economical manner. This study therefore adopted the mixed method research approach and employed the concurrent design. Creswell (2005) describes the research approach as involving philosophical assumptions, the use of qualitative and quantitative approaches, and the mixing of both approaches in a study. On the other hand, concurrent design of this approach allowed the researcher to converge qualitative and quantitative data to enable comprehensive analysis of the research problem. According to Bwisa (2015b) in his guide to research methods and while elaborating on the common methods and types of social science research, notes that qualitative research is primarily an exploratory research and enables the research gain understanding of the underlying opinions, reasons, and motivations while providing insight into the problem for potential qualitative research. Further that quantitative research on the other hand, is formal, objective; systematic processes in which the numerical data are used to obtain information about the world and enables the researcher examine the relationships among variables.

**Target Population**

According to Raymond and Bergeron (2011), target population is the larger population to which the researcher ultimately would like to generalize the results of the study. Nairobi vision 2030 metropolitan report (2008) lists constituents to include Nairobi, Kiambu, Machakos and Kajiado counties. In order to realise its seventh key result area (KRA) of a safe and secure region, the report identifies fourteen sub county fire stations within the listed counties as area of focus. These stations are listed as: Nairobi; Kiambu; Olkejuado; Thika; Machakos; Ruiru; Limuru; Masaku; Kikuyu; Githunguri; Kiambaa; Kajiado; Mavoko; and Kang‘undo. Out of the fourteen listed only six fire stations located in Nairobi and Kiambu counties have embraced PMIS technology in various forms according the reviewed report 2010 (Nairobi vision 2030 report review, 2010). These six stations include: Nairobi; Thika; Machakos; Limuru; Kikuyu; and Kiambu. Thus these six fire stations have been proposed to qualify as the target fire stations for the study.
The six fire stations identified above allow the researcher to define the target respondents of the proposed study. The researcher identified six categories of the target respondents, namely, directors, fire station commander, head of departments, ambulance attendants, first aiders, and lead firemen. In addition, there were 119 Nairobi county fire station personnel, 27 for Machakos county and 88 for Kiambu county and hence the total target population was 234 comprising of 3 directors, 8 fire station commanders, 22 heads of departments, 26 ambulance attendants, 28 first aiders, and 147 lead firemen. The target populations were then stratified as shown in Table 1 below.

<table>
<thead>
<tr>
<th>No.</th>
<th>Strata</th>
<th>Nairobi</th>
<th>Thika</th>
<th>Kiambu</th>
<th>Machakos</th>
<th>Limuru</th>
<th>Kikuyu</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Directors</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Fire Station Commander</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Head of Departments</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>4</td>
<td>Ambulance Attendants</td>
<td>12</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>5</td>
<td>First Aiders</td>
<td>20</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>6</td>
<td>Lead Firemen</td>
<td>74</td>
<td>27</td>
<td>12</td>
<td>16</td>
<td>14</td>
<td>4</td>
<td>147</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>119</td>
<td>37</td>
<td>18</td>
<td>27</td>
<td>21</td>
<td>12</td>
<td>234</td>
</tr>
</tbody>
</table>

*Source: Kenya Fire Brigade Association (KENFIBA, 2015)*

Census Study

The actual respondents for the research were made up of 234 fire station personnel from the fire stations in Nairobi Metropolis, Kenya that comprised the target population. Since the population is small, a census method was applied to consider all the respondents in the survey. This was therefore a census survey encompassing all the directors, station commanders, head of departments, ambulance attendants, first aiders, and lead firemen. Pilot census was conducted at Kericho County Fire Station which is under the Kisumu Metropolis, Kenya.

Research Instruments

Quantitative data was collected from the fire stations through administering a questionnaire while qualitative data was collected through application of interview guide and use of observation guide to compliment the qualitative data. The questionnaire was applied to collect primary data. Creswell (2005) indicates that the questionnaire as an instrument has the advantage of reaching out to large numbers of respondents within a short time; is able to give the respondents adequate time to respond to the items; offers a sense of security in terms of
confidentiality to the respondents; and finally notes that it is an objective method since there is no bias resulting from the personal characteristics as in an interview.

**Reliability of the Instruments**

According to Njoki (2013) reliability refers to the consistency of measurements in that it is the degree to which the instruments gives similar results over a number of repeated trials. Njoki further notes that in social science research, reliability is frequently assessed using the test – retest reliability method and that reliability is increased by including as many similar items on a measure, by testing a diverse sample of individuals and by using uniform testing procedures. The researcher selected a pilot group comprising of 10% of the population under study to test the reliability of the research instruments (Creswell, 2004). The main aim was to correct inconsistencies arising from the instruments, which ensured that they measure what is intended. The research instruments were subjected to overall reliability analysis using the split half method. This was done by collecting data from a given number of the respondents into two halves (often odd-even). The two halves were then correlated using Pearson’s correlation. A coefficient of 0.7 or more implied that there is a high degree of data reliability (Lim & Mohamed, 2000).

**Data Processing and Analysis**

Data analysis involves getting the feel for the data, testing the goodness of the data and finally testing the hypothesis developed for the research with the main aim being making sense out of text and image data (Creswell, 2003). Data processing therefore involves preparing data for analysis, moving deeper into understanding it, presenting it and making interpretation for a larger meaning. Creswell further notes that data analysis first involved coding the responses, tabulating the data, and performing several statistical computations which relates mostly to averages, frequencies, percentages, and regression coefficients.

On top management support, the researcher shall collect both qualitative and quantitative data. For the qualitative data, thematic areas were identified and the responses placed into particular themes, each of which were coded as standalone variables. From these descriptive statistics was generated and thereby creating a platform for linkage with literature and hence some inference. The researcher has also asked for the number of disaster management response projects that the stations were able to handle before the implementation of the form of PMIS in place and the number thereafter. Such data was analysed using the t-test to evaluate existence of any significant impact(s) of PMIS. Finally, the researcher constructed a likert scale for the sub-variables that ensued from this specific objective and for this data was analysed using the ordinal regression model.
Statistical Measurement Model

According to Kothari (2004) and Creswell (2003), multiple regression analysis attempts to determine whether a group of variables when combined together can predict a given dependent variable and in essence attempt to increase the accuracy of the estimate. The general multiple regression models for this study was:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

Where:

- $Y$ = is the dependent variable uptake of PMIS
- $\beta_0$ is the constant
- $\beta$ is the coefficient of $X_i$ for $i = 1, 2, 3$
- $X_1$ is the Perceived PMIS Usefulness
- $X_2$ is the Key-Staff Involvement
- $X_3$ is the Communication
- $\beta_1, \beta_2, \beta_3$, are the regression coefficients
- $\varepsilon$ is the error term brought about by the environment.

RESEARCH FINDINGS AND DISCUSSIONS

Descriptive Analysis on General Characteristics

In order to describe the demographic characteristics of the study respondents and assess whether there is any influence on the research findings, the study analyzed the demographic characteristics of the demographic data which includes the fire station departments, respondent experience at the station, respondent age, respondent gender, and PMIS implemented at the station.

When descriptive statistics was done on the demographic statistics it was found that, respondent station had a mean of 3.293 and a standard deviation of 0.984, fire station departments had a mean of 5.608 and a standard deviation of 1.968, respondent experience at the station had a mean of 2.506 and a standard deviation of 1.419, respondents gender had a mean of 1.458 and a standard deviation of 0.4990, fire station’s PMIS implemented had a mean of 4.070 and a standard deviation of 1.183, while the dependent variable, PMIS uptake, had a mean of 2.383 and a standard deviation of 0.777. The results of this analysis are shown in table 2 below.

<table>
<thead>
<tr>
<th>Table 2: Descriptive Analysis on Demographic Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>Respondent Station</td>
</tr>
</tbody>
</table>
A similar study by Mabry et al. (2013) also found out that the various departments within the fire station plays a big role in the uptake of technology like PMIS. Further they note that it is important the fire stations’ PMIS implemented is one that is universally accepted by the members of the various fire station departments. Otieno et al. (2010) and Njoki (2010) also found out that the implementation of technology is not very dependent on experience at the station and certainly not dependent on gender of the personnel. These findings gives an indication that the uptake of PMIS in disaster management project at the fire stations is more dependent on the fire stations departments, the fire station’s PMIS implemented and to a small extent the station itself in how it handles the uptake. However it also indicates that the uptake is not necessarily dependent on the gender and experience at the fire stations.

A regression analysis was then used to test if there was a significant influence of the demographic factors (Respondent station, fire station departments, respondent experience at the station, respondent gender, fire stations’ PMIS implemented) on the extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya. Since p (0.000) is less than alpha (.05), the research concluded that with the obtained data, there was evidence of a significant effect of demographic factors on the PMIS uptake in disaster management projects at the fire stations in Nairobi Metropolis, Kenya (F20.421, Df=9, and P<0.05). The result of this analysis is presented in table 3 below.

Table 3: ANOVA results showing the effect of demographic characteristics on the extent of PMIS uptake in Disaster Management Projects in Nairobi Metropolis, Kenya

<table>
<thead>
<tr>
<th>ANOVA</th>
<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></td>
<td>Regression</td>
<td>71.100</td>
<td>9</td>
<td>7.910</td>
<td>20.421</td>
<td>.000&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>161.865</td>
<td>218</td>
<td>.378</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>232.965</td>
<td>227</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Respondents Gender, Fire Station Departments, Respondent Experience at the station, Respondent Station
b. Dependent Variable: PMIS_Uptake

Source: SPSS Ver. 21 Generated analysis for the study
Regression analysis was done to determine the influence of demographic characteristics on the extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya. The analysis of the demographic factors obtained an adjusted $R^2$ of 0.360. This implies that the simple linear model with demographic factors as the independent variables explains 36.0% of the variations in the extent of PMIS uptake in fire stations projects. This explains further that with the demographic factors as the only independent variables, the extent of PMIS uptake in fire stations projects will change by 36.0%. These results are shown in table 4 below.

**Table 4: Model summary showing demographic characteristics of respondents**

<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>0.614(a)</td>
<td>0.378</td>
<td>0.360</td>
<td>0.62400</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Respondents Gender, Fire Station Departments, Respondent Experience at the station, Respondent Station

Source: SPSS Ver. 21 Generated analysis for the study

This finding is similar to that of Geist and Lambin (2002) who found out that demographic factors contributed to an additional 61% of the economical and statistical analysis factors that influence the uptake of technology in fire stations. Also a study by Green, Grace and Gleser (1985) opined in the similar that demographic factors which included the fire departments and the type of technology implemented contributed to 14% of the prediction measures on the final result. These indications are also confirmed by Casner, Andersen, and Isaacs (2005) who concluded that demographic characteristics have an impact on the spontaneous circulation of a technology device called CPR assist in the management of disasters at the hospitals. This is can be concluded that demographic characteristics at the fire stations across the country have a significant influence on the extent of Uptake of PMIS in disaster management projects.

The researcher conducted a correlation analysis to investigate the existence and nature of relationship between demographic characteristics and PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya. From the correlation analysis it was noted that fire stations’ PMIS implemented had the highest positive relationship with PMIS uptake with a Beta value of 0.252, the second highest score was the respondents experience at the station with a Beta value of 0.187 while respondents station and respondents gender had low positive Beta values of 0.009 and 0.017 respectively. This shows therefore that there is some minimal positive relationship between demographic characteristics and the extent of PMIS uptake in disaster...
management projects in fire stations in Nairobi Metropolis, Kenya. Fire station departments had a negative Beta value of 0.051 indicating a negative relationship with extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya. Respondents stations explains a 0.8% variance in PMIS uptake, respondents experience at the station explains 10.2% variance in PMIS uptake, respondents gender explains 2.6% variance in PMIS uptake, and fire station’s PMIS implemented explains 1.67% variance in PMIS uptake. This variance therefore showed that there is a positive relationship between the demographic characteristics and extent of PMIS uptake in disaster management projects, Kenya. Fire station departments explains a -2.1% variance in PMIS uptake indicating that there is a negative relationship with PMIS uptake in disaster management project in fire stations in Nairobi Metropolis, Kenya. The results of this analysis are shown in table 5 below.

**Table 5: Coefficient results showing the relationship between the demographic characteristics and PMIS uptake**

<table>
<thead>
<tr>
<th>Coefficients (a)</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Constant</td>
<td>1.166</td>
<td>.477</td>
</tr>
<tr>
<td>Respondent Station</td>
<td>.008</td>
<td>.045</td>
</tr>
<tr>
<td>Fire Station Departments</td>
<td>-.021</td>
<td>.026</td>
</tr>
<tr>
<td>Respondents Experience at the station</td>
<td>.102</td>
<td>.049</td>
</tr>
<tr>
<td>Respondents Gender</td>
<td>.026</td>
<td>.083</td>
</tr>
<tr>
<td>Fire Stations’ PMIS Implemented</td>
<td>.167</td>
<td>.048</td>
</tr>
</tbody>
</table>

a. Dependent Variable: PMIS Uptake

*Source: SPSS Ver. 21* Generated analysis for the study

The study also conducted a correlation analysis to investigate if there is a significant relationship between the demographic factors (Respondent Station; Respondent Experience at the station; Respondent Gender; Respondents Department; and PMIS implemented) and the extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya. From the analysis it was found that there is a significant positive relationship between PMIS uptake and respondent station, significant relationship between respondent experience at the station and PMIS uptake, and significant relationship between PMIS implemented and PMIS uptake. However it was also noted that the relationship between the respondents’ gender and PMIS uptake and the relationship between the fire station’s departments and PMIS uptake were not significant.
From the analysis it was also evident that there was a significant positive relationship between respondent fire station and fire station department; respondent fire station and respondent experience at the station; and respondent fire station and fire station’s PMIS implemented. However there was a significant negative relationship between the respondent station and respondent gender. It was also observed from the analysis that there was a significant relationship between fire station department and the respondent experience at the station; fire station department and respondent gender; and finally fire station department and the fire station’s PMIS implemented. There was also a significant positive relationship between respondent experience at the station and fire station’s PMIS implemented while the relationship between respondent experience at the station and respondent gender was negative. Finally it was also established that there exist a significant positive relationship between respondent gender and the fire station’s PMIS implemented. The results is as indicated in table 6 below.

**Table 6: Correlations coefficients on demographic characteristics and extent of PMIS uptake in Disaster Management Projects in Fire Stations in Nairobi Metropolis, Kenya**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Respondent Station</td>
<td></td>
<td>Pearson Correlation</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sig. (2-Tailed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>228</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Fire Station Department</td>
<td>.311**</td>
<td>Pearson Correlation</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.000</td>
<td>Sig. (2-Tailed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>228</td>
<td>N</td>
<td>228</td>
<td>228</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Respondent Experience at station</td>
<td>.368**</td>
<td>Pearson Correlation</td>
<td>.387(**)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.000</td>
<td>Sig. (2-Tailed)</td>
<td>.000</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>228</td>
<td>N</td>
<td>228</td>
<td>228</td>
<td>228</td>
<td></td>
</tr>
<tr>
<td>4 Respondent Gender</td>
<td>-.061</td>
<td>Pearson Correlation</td>
<td>.309(**)</td>
<td>-.121*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.292</td>
<td>Sig. (2-Tailed)</td>
<td>.000</td>
<td>.032</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>228</td>
<td>N</td>
<td>228</td>
<td>228</td>
<td>228</td>
<td>228</td>
</tr>
<tr>
<td>5 Fire Station’s PMIS Implemented</td>
<td>.570(**)</td>
<td>Pearson Correlation</td>
<td>.372(**)</td>
<td>.577(**)</td>
<td>.174(**)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>.000</td>
<td>Sig. (2-Tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td></td>
<td>228</td>
<td>N</td>
<td>228</td>
<td>228</td>
<td>228</td>
<td>228</td>
</tr>
<tr>
<td>6 PMIS Uptake</td>
<td>.228**</td>
<td>Pearson Correlation</td>
<td>.030</td>
<td>.378**</td>
<td>.139*</td>
<td>.332**</td>
</tr>
<tr>
<td></td>
<td>.000</td>
<td>Sig. (2-Tailed)</td>
<td>.610</td>
<td>.000</td>
<td>.015</td>
<td>.000</td>
</tr>
</tbody>
</table>
Top Management Support and Extent of PMIS Uptake

This section analyses and presents factor analysis on top management support and the extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya. The research section focused on the core variables of top management support which were: Perceived usefulness; key-staff involvement; and communication.

**a) Top management perceived usefulness and extent of PMIS uptake**

From the analysis majority of the respondents at 77.2% (176) were not aware whether a contract between the fire station and PMIS service provider existed for the PMIS implemented at the station while minority representing 2.6% (6) gave an indication that there was an existing contract for the PMIS implemented at the station which is an indication that the contract existence is only known by the station’s top management. Also 20.2% (46) of the respondents indicated that there was no existence of a contract for the PMIS implemented. The results of this analysis is indicated in table 7 below.
Table 7: Contractual agreement with the service provider on PMIS implemented at the stations.

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>6</td>
<td>2.0</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>No</td>
<td>46</td>
<td>19.7</td>
<td>20.2</td>
<td>22.8</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>176</td>
<td>68.9</td>
<td>77.2</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>228</strong></td>
<td><strong>90.6</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>234</strong></td>
<td><strong>100.0</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: SPSS Ver. 21 Generated analysis for the study

These findings are similar with those of Lewis, Agarwal and Sambamurthy (2003) whose findings indicated that beliefs about technology usefulness are influenced by top management commitment to the uptake process. Further Davis, Bagozzi and Warshaw (1989) findings that top management perceived usefulness of a technology had the guiding factor in its implementation, is also attested by these results. The findings therefore affirms that top management support plays a significant role in perceived usefulness of PMIS uptake in disaster management projects in fire stations.

When factor analysis was conducted on the perceived usefulness and top management support only one component was extracted for the 11 items. However from the analysis two items were suppressed and dropped from further analysis because they had a loading of lower than 0.4. Analysis of the factors loading revealed that the contract ensures that fire personnel have skills required to use PMIS had the highest loading value of 0.757. The other variables had loading values as follows: Contract ensures each fire personnel using the PMIS goes through training yearly had a loading value of 0.738; PMIS service contractor will conduct extensive training in aspect PMIS quality had a loading value of 0.734; New PMIS knowledge impacted periodically as per contract as they work in squads had a loading value of 0.714; Contract enables employees to take more responsibilities using the PMIS had a loading value of 0.651; Contract performance appraisal enable identification of PMIS training needs had a loading value of 0.647; PMIS contract ensures real-time support to fire personnel in the field had a loading value of 0.602; Contract training agreement leads to improved fire personnel performance using PMIS had a loading value of 0.574; and finally PMIS contract ensures continuous main-tenance to the system to reduce downtime had a loading value of 0.555. The following items were suppressed and dropped from further analysis because they had loading values of less than 0.4: PMIS contract is an indication of modernization of the fire station had a loading value of 0.180; and PMIS contract has a great effect on the performance of fire personnel had a loading value of 0.164. These results are presented in table 8 below.
Table 8: Factor analysis showing perceived usefulness and top management support of PMIS at the fire stations

<table>
<thead>
<tr>
<th>Component Matrix</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Contract ensures that fire personnel have skills required to use PMIS</td>
<td>.757</td>
</tr>
<tr>
<td>Contract ensures each fire personnel using the PMIS goes through training yearly</td>
<td>.738</td>
</tr>
<tr>
<td>PMIS service contractor will conduct extensive training in aspect PMIS quality</td>
<td>.734</td>
</tr>
<tr>
<td>New PMIS knowledge impacted periodically as per contract as they work in squads</td>
<td>.714</td>
</tr>
<tr>
<td>Contract enables employees to take more responsibilities using the PMIS</td>
<td>.651</td>
</tr>
<tr>
<td>Contract performance appraisal enable identification of PMIS training needs</td>
<td>.647</td>
</tr>
<tr>
<td>PMIS contract ensures real-time support to fire personnel in the field</td>
<td>.602</td>
</tr>
<tr>
<td>Contract training agreement leads to improved fire personnel performance using PMIS</td>
<td>.574</td>
</tr>
<tr>
<td>PMIS contract ensures continuous maintenance to the system to reduce downtime</td>
<td>.555</td>
</tr>
<tr>
<td><strong>PMIS contract is an indication of modernization of the fire station</strong></td>
<td>.180</td>
</tr>
<tr>
<td><strong>PMIS contract has a great effect on the performance of fire personnel</strong></td>
<td>.164</td>
</tr>
</tbody>
</table>

Note: the bolded items were dropped from further analysis.

Source: SPSS Ver. 21 Generated analysis for the study

When reliability test was done using the Cronbach’s Alpha for the items, before removing and after removing the inadequate indicator, it was found that the value was 0.762 before removing and it increased to 0.815 after removing the inadequate indicator. According to Ngui (2014) while quoting Creswell (2003) notes that the closer the Cronbach’s alpha is to one, the higher the internal consistency reliability. Therefore the results of this analysis indicates that the data collected was reliable since the alpha coefficient values of 0.762 and 0.815 were very close to one as obtained from the research variables. These were above 0.75 and an alpha coefficient of higher than 0.75 signifies that the data gathered has a relatively high internal consistency and therefore can be generalized to the respondents’ opinion on the study problem. The results of this analysis are as presented in table 9 below.

Table 9: Reliability analysis for perceived usefulness and top management support of PMIS at the fire stations

<table>
<thead>
<tr>
<th>Cronbach’s Alpha</th>
<th>Cronbach’s Alpha Before Extracting a</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before removing the inadequate indicator</td>
<td>0.762</td>
<td>11</td>
</tr>
<tr>
<td>After removing the inadequate indicator</td>
<td>0.815</td>
<td>9</td>
</tr>
</tbody>
</table>

Source: SPSS Ver. 21 Generated analysis for the study

b) Top management key staff involvement support and extent of PMIS uptake

The study conducted an analysis on the number of disaster response projects the fire stations can handle without the application of any form of technology management system at the the fire stations at Nairobi Metropolis,
Kenya. Majority of the respondent at 82.0% (187) indicated that the response would be less than 20 disaster response projects, with 17.1% indicating a response of between 20 and 50 disaster response projected while only 0.9% (2) was of the view that the disaster response projects will be over 50. This finding is consistent with the findings of International Federation of the Red Cross (IFRC, 2014) report on global disaster occurrences. IFRC (2014) notes that on average there were 8869 disasters worldwide in the year 2014 and out of this figure Africa had 1522 and while Kenya contributed an average of 342 disasters to the African figure. This is an indication that technology has not been fully embraced to combat disasters. The result of the analysis is as presented in table 10 below.

**Table 10: Fire stations' annual disaster response projects without use of any form technology.**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20</td>
<td>187</td>
<td>79.9</td>
<td>82.0</td>
</tr>
<tr>
<td>Between 20 to 50</td>
<td>39</td>
<td>16.8</td>
<td>17.1</td>
</tr>
<tr>
<td>Over 50</td>
<td>2</td>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>Total</td>
<td>228</td>
<td>97.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>234</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

*Source: SPSS Ver. 21 Generated analysis for the study*

The above findings are consistent with the view of various authors (Karodia, Cowden & Magaba, 2014; Ahuja, Yang & Shankar, 2010; Barki and Huff, 2005) whose opinions were that technology aids in the implementation of projects such as disaster management projects and the failure to use PMIS in form would eventually lead to low number of projects completed in a given year. This therefore indicates that a failure by top management to support the uptake of PMIS in disaster management projects in fire stations in Nairobi Metropolis, Kenya would eventually lead to low number of projects completed within a given period of time.

The research also analyzed responses of the respondents on the number of disaster response projects where technology was to be applied in any form. From the analysis it was noted that majority of the respondents at 89.9% (205) were of the view that the disaster response project will be above 50 were technology to be applied in any form while 6.1% (14) were of the view that the response project will be between 20 and 50 and minor 4.0% (9) indicated that the disaster response projects will be less than 20 were technology to be applied in any form.
Table 11: Fire stations’ annual disaster response projects where technology is applied in any form

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20</td>
<td>9</td>
<td>3.9</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Between 20 to 50</td>
<td>14</td>
<td>5.8</td>
<td>6.1</td>
<td>10.1</td>
</tr>
<tr>
<td>Over 50</td>
<td>205</td>
<td>87.6</td>
<td>89.9</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>228</td>
<td>97.3</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>6</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>234</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: SPSS Ver. 21 Generated analysis for the study

This findings is similar to that done by several authors whose findings opined that the use of technology in projects within an organization or company increases the number of projects completed within a given period of time and therefore the support of top management on technology implementation reflects directly on the number of projects completed (Karodia, Cowden & Magaba, 2014; Ahuja, Yang & Shankar, 2010; Barki and Huff, 2005). This therefore concludes that top management support of technology uptake in disaster management projects in fire stations is a receipt to high number of projects completed within a period of time.

c) Top management communication support and extent of PMIS uptake

In analyzing communication channel used by top management the study considered the means as telephone, e-mail, memos, meetings, and letters. From the analysis it was evident that majority of the respondents at 42.5% (97) were of the opinion that telephone is mostly used followed by meetings at 24.5% (56) and memos at 23.6% (54). However the respondents had a lower considerable opinion on the usage of e-mail and letters at 2.1% (5) and 7.3% (16) respectively. Malcom (2010) notes that it is standard practice for disaster management project response apparatus to have radio telephone. The analysis is presented in table 12 below.

Table 12: Communication channel used by top management in communicating with fire team involved in disaster management projects

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone</td>
<td>97</td>
<td>41.8</td>
<td>42.5</td>
<td>42.5</td>
</tr>
<tr>
<td>E-Mail</td>
<td>5</td>
<td>1.9</td>
<td>2.1</td>
<td>44.6</td>
</tr>
<tr>
<td>Memos</td>
<td>54</td>
<td>23.3</td>
<td>23.6</td>
<td>68.2</td>
</tr>
<tr>
<td>Meetings</td>
<td>56</td>
<td>24.1</td>
<td>24.5</td>
<td>92.7</td>
</tr>
<tr>
<td>Letters</td>
<td>16</td>
<td>6.9</td>
<td>7.3</td>
<td>100</td>
</tr>
</tbody>
</table>
This finding is consistent with those of other authors who opined that communication plays an important role in PMIS uptake in disaster management projects in fire stations and that it helps in diffusing the acceptance to the lowest levels of the station (Pan and Jang, 2008; Oliveira and Martins, 2011). Further Premkumar and Roberts (2009) findings concur with the findings above that top management support through communication is commonly done through telephone, e-mail and meetings with the stakeholders involved in PMIS uptake in disaster management projects. These assertions therefore mean that the major component of communication by the top management in support of PMIS uptake is the use of telephone, meetings and memos at the fire station in Nairobi Metropolis, Kenya.

The research also seek to establish whether the communication channels used by the top management in communicating with fire team involved in disaster management projects was part of a reporting standard requirement at the station. From the analysis it was found that majority of the respondents at 68.8% (157) indicated in the affirmative while 18.8% (43) indicated no. Of the 228 respondents that answered the question, 12.4% (28) did not know whether the communication channel used by the top management was part of a standard procedure or not. The result of this analysis is presented in table 13 below.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>157</td>
<td>67.5</td>
<td>68.8</td>
<td>68.8</td>
</tr>
<tr>
<td>No</td>
<td>43</td>
<td>18.2</td>
<td>18.8</td>
<td>87.6</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>28</td>
<td>11.7</td>
<td>12.4</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>228</td>
<td>97.4</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing</td>
<td>0</td>
<td>2.6</td>
</tr>
<tr>
<td>Total</td>
<td>234</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: SPSS Ver. 21 Generated analysis for the study

Kaiser and Ahlemann (2010) in their study dubbed *measuring project management information systems success* notes that information technology has been embraced in major organizations including fire stations and its use embedded in daily operational policies and standards. The analysis of this study therefore confirms the study in retrospect as it defines the usage of technology at the fire stations. Oliveira and Welch (2013) further confirms
that local governments which includes fire department which are part of the local governments use technology aided communication strategies as part of standard reporting procedures and PMIS generated reports from disaster management projects forms part of the standard reports.

PMBOK (2008) outlines specific variables that are strategically considered to aid the uptake of any technology in an organization PMIS included. Malcom (2010) and Njoki (2013) also provide preliminary variables considered to be perceived as of importance when implementing technology that includes PMIS in an organization. It is for this particular reason that the research sort to find out the influence of top management support variables on the extent of PMIS uptake in disaster management in fire stations in Nairobi Metropolis, Kenya. Majority of the respondents at 48.6% were not sure whether the station management has a solid contract with the PMIS software providers while 44.2% did not agree with the statement and only 7.2% agreed with the statement. Majority of the respondents (60.9%) agreed that station management has involved key staff to handle the processes, schedules and reporting of PMIS in disaster management projects implementation, also large majority at 70.3 agreed that station management involves PMIS in all the phases of fire station projects. Only a small percentage of the respondents (8.6%) agreed with the statement that station management keeps pressure on the fire station team to use PMIS in all the phases of disaster management project but majority of the respondents at 78.3% agreed that fire station management considers PMIS as a strategic resource. The following statement had an agreement rate as follows: Reports are generated using PMIS for presentation to the station management at the county office had an agreement rate of 76.7%; station chief officer is involved as key authorization officer during the start of any project and PMIS use is part of the authorization had an agreement rate of 99.6%; Station management organizes on-going training on the use of the indicated PMIS had an agreement rate of 7.3%; The PMIS reporting requirement has enabled the station managers to put in place communication plan had an agreement rate of 62.9%; The performance contracts are based on progress reports generated using PMIS in every phase of the disaster management project had an agreement rate of 48.5%; Top management has supported new IT systems and technologies in disaster project management to enhance fire service delivery had an agreement rate of 71%; and the statement the most important phases of disaster project management supported by top management includes: conception; design; response operation; and recovery & reporting had an agreement rate of 12.4%. The result of this analysis is presented in table 14 below.
Table 14: Top management support factors and extent of PMIS uptake

<table>
<thead>
<tr>
<th>Indicators</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station management has a solid contract with the PMIS software providers.</td>
<td>18.6</td>
<td>25.6</td>
<td>48.6</td>
<td>7.2</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Station management has involved key staff to handle the processes, schedules and reporting of PMIS in disaster management projects implementation.</td>
<td>8.6</td>
<td>3.6</td>
<td>26.9</td>
<td>48.2</td>
<td>12.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Station management involves PMIS in all the phases of fire station projects.</td>
<td>11.3</td>
<td>5.5</td>
<td>12.9</td>
<td>58.1</td>
<td>12.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Station management keeps pressure on the fire station team to use PMIS in all the phases of disaster management project.</td>
<td>75.3</td>
<td>9.7</td>
<td>6.4</td>
<td>8.6</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Fire station management considers PMIS as a strategic resource.</td>
<td>5.9</td>
<td>3.7</td>
<td>12.1</td>
<td>49.7</td>
<td>28.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Reports are generated using PMIS for presentation to the station management at the county office.</td>
<td>2.8</td>
<td>16.2</td>
<td>4.3</td>
<td>62.4</td>
<td>14.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Station chief officer is involved as key authorization officer during the start of any project and PMIS use is part of the authorization.</td>
<td>0.4</td>
<td>0.0</td>
<td>0.0</td>
<td>71.5</td>
<td>28.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Station management organizes on-going training on the use of the indicated PMIS.</td>
<td>8.2</td>
<td>48.2</td>
<td>36.3</td>
<td>3.3</td>
<td>4.0</td>
<td>100.0</td>
</tr>
<tr>
<td>The PMIS reporting requirement has enabled the station managers to put in place communication plan.</td>
<td>6.7</td>
<td>2.3</td>
<td>28.1</td>
<td>58.7</td>
<td>4.2</td>
<td>100.0</td>
</tr>
<tr>
<td>The performance contracts are based on progress reports generated using PMIS in every phase of the disaster management project.</td>
<td>32.1</td>
<td>11.3</td>
<td>8.1</td>
<td>45.4</td>
<td>3.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Top management has supported new IT systems and technologies in disaster project management to enhance fire service delivery.</td>
<td>11.2</td>
<td>7.3</td>
<td>10.5</td>
<td>70.5</td>
<td>0.5</td>
<td>100.0</td>
</tr>
<tr>
<td>The most important phases of disaster project management supported by top management includes: conception; design; response operation; and recovery &amp; reporting.</td>
<td>7.5</td>
<td>0.3</td>
<td>79.8</td>
<td>11.6</td>
<td>0.8</td>
<td>100.0</td>
</tr>
</tbody>
</table>

SD = strongly disagree; D = disagree; N = neutral; A = agree; SA = strongly agree

Source: SPSS Ver. 21 Generated analysis for the study

d) Regression analysis of top management support and extent of PMIS uptake
The researcher conducted a regression analysis to determine the significant relationship of top management support against the extent of PMIS uptake. Table 15 shows that the coefficient of determination is 0.569 therefore this means that about 56.9% of the variation in the extent of PMIS uptake is explained by top management support. The regression equation appears to be relatively useful for making prediction since the values of $R^2$ is slightly more than a half.

**Table 15: Model summary for top management support**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Squared</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.757(^a)</td>
<td>.572</td>
<td>.569</td>
<td>.603</td>
</tr>
</tbody>
</table>

\(^a\) Predictors: (Constants), Top management support

*Source: SPSS Ver. 21 Generated analysis for the study*

Table 16 presents the results of the Analysis of Variance (ANOVA) on the top management support versus the extent of PMIS uptake. The ANOVA results for regression coefficients indicate that the significance of the F is 0.00 which is less than 0.05. This indicates that the regression model statistically predicts the outcome variable hence meaning it is a good fit for the data. Therefore from the results there is a significant relationship between top management support and the extent of PMIS uptake.

**Table 16: 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 Regression</td>
<td>18.179</td>
<td>1</td>
<td>18.179</td>
<td>50.336</td>
<td>.000(^a)</td>
</tr>
<tr>
<td>Residual</td>
<td>13.725</td>
<td>227</td>
<td>.363</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>31.904</td>
<td>228</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Predictors: (Constant), Top management support

The ANOVA results are corroborated by the findings of Young and Jordan (2008) and Feder and Slade (1984) who concluded that top management support has a significant relationship with technology uptake and further suggesting that the top management support encourages technology usage, better performance, and heightens the uptake levels within the organization.

The research also sort to determine the beta coefficients of top management support verses the extent of PMIS uptake in disaster management projects at the fire stations. Table 17 show that there was a positive relationship since the coefficients of top management support was 0.808 which is significantly greater than zero. The t statistic (7.097) was also greater than zero hence demonstrating that the top management support had a positive influence on the extent of PMIS uptake. With the significance coefficient value of 0.000 which is less than the
p-value of 0.05, we reject the null hypothesis that there is no significance relationship between top management support and the uptake of PMIS in disaster management projects in fire stations in Nairobi Metropolis, Kenya.

### Table 17: Coefficients

<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 (Constant)</td>
<td>.609</td>
<td>.414</td>
<td>1.480</td>
<td>.150</td>
</tr>
<tr>
<td>Top management support</td>
<td>.808</td>
<td>.116</td>
<td>.757</td>
<td>7.097</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Extent of PMIS Uptake

The *t*-statistical analysis concurs with the studies done by several authors that top management support contributes a significant positive influence on the uptake on PMIS in disaster management projects in fire stations and confirmed also as the guiding managerial intervention aimed at ensuring that there is full uptake of the technology and its applications (Malcolm, 2010; Davis, Bagozzi & Warshaw, 1989; Lewis, Agarwal & Sambamurthy, 2013; Karodia, Cowden & Magaba, 2014; Ahuja, Yang & Shankar, 2010).

### Aggregate of the Independent Variables

Top management support was considered by the research as the dimension/component of the independent variable of the study on the dependent variable which was the uptake of PMIS. With regard to top management support the finding revealed that it had a mean of 3.6618 and a standard deviation of 0.77222 with the respondents comprising those disagreed to those strongly agreeing. These assertions are presented in table 18 below:

### Table 18: Summary of mean and standard deviation of technology uptake factors

<table>
<thead>
<tr>
<th>Technology Uptake Factors</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Management Support</td>
<td>3.6618</td>
<td>.77222</td>
<td>2.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Ranked on a scale: 1 – 1.8 (strongly disagree): 1.8 – 2.6 (disagree):
2.6 – 3.4 (neutral): 3.4 – 4.2 (agree): 4.2 – 5.0 (strongly agree)

*Source: SPSS Ver. 21 Generated analysis for the study*

### Normality Test

Park (2015) while studying univariate analysis and normality test using SAS, Stata and SPSS notes that for a model to fit to some given data, the dependent variable in this case the uptake of PMIS has to be normality distributed.
**Q-Q Plot**

For a normally distributed data Wang *et al.* (2011, December) opined that the observed values should be spread along a straight diagonal line in a plotted graph. From figure 1 below most of the observed values are spread very close to the straight line and some falling within the line. This therefore shows that there is a highly likelihood that the data is normally distributed. This finding therefore confirms the Q – Q plot below.

![Q-Q Plot](source.png)

*Source: SPSS Ver. 21 Generated analysis for the study*

*Figure 1: Normal Q – Q Plot of Uptake of PMIS*

**SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

**Summary of Findings**

From this research, it was found that top management support have a positive influence on the extent of PMIS uptake in disaster management projects in fire stations in Kenya. From the study it was also found out that the demographic characteristics have a significant effect on the extent of PMIS uptake. With demographic factors as the only independent variables of the study the uptake of PMIS will change by 36.0%. From the study it was found that respondent experience at the station and fire stations’ PMIS implemented had the highest positive relationship with the extent of PMIS uptake in disaster management projects while fire station departments had a negative relationship with the extent of PMIS uptake. However the relationship between respondent station and respondent gender and the extent of PMIS uptake were considered as not significant. Therefore as the percentage of respondents experience at the station and fire stations’ PMIS implemented increases, it is expected that there will be a change in the extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya.
From the research it was found out that there is a significant relationship between top management support and the extent of uptake of PMIS in disaster management projects in fire stations in Nairobi Metropolis, Kenya. It was also found that top management factors have a positive effect on the extent of PMIS uptake. In general, this study found that three sets of top management support factors – top management perceived usefulness, top management key staff involvement support, and top management communication support contributed significantly to extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya. When all these factors were applied, it was found that the extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya will improve by 56.9%. This finding is consistent with those of Young and Jordan (2008) who suggests that top management support is the most important and critical success factor for a project success and justifies this in the context of project management as not one of the many factors but a technology uptake factor to significantly consider during technology implementation in projects. The study also corroborates the findings of Zwikael (2008) and Kwak and Anbari (2009) who opined that top management support highly influences the extent the tools of project management which includes PMIS are procured and used in a given project and the extent of the use of the tool is wholly dependent on the support given to the fire stations by their top management.

**Conclusions**

From the study it is concluded that top management support have a significant positive influence on the extent of uptake of PMIS in disaster management in fire stations in Nairobi Metropolis, Kenya. When top management factors (perceived PMIS usefulness, key-staff involvement, and communication) were used, it was found out that there was a 56.9% variance in extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya. Among the three factors of top management, perceived PMIS usefulness and key-staff involvement are considered highly significant factors which influence uptake of PMIS. However communication has the least influence on the uptake of PMIS.

Therefore top management support influences the extent of PMIS uptake to a very great extent. Based on the results of the study, it is concluded that using only perceived PMIS usefulness and key-staff involvement is not sufficient to improve the uptake of the PMIS. If all fire stations in Nairobi Metropolis use all the top management support factors together, they will increase the uptake of PMIS. This is because there is a strong positive correlation between top management support and extent of PMIS uptake. From this study it is also concluded that demographic characteristics have a significant influence on the extent of PMIS uptake in disaster management projects in fire stations in Nairobi Metropolis, Kenya. With demographic factors as the only
independent variables, the extent of uptake of PMIS in disaster management projects in fire stations will change by 36.0%. From the obtained data it was concluded that there is a significant influence of respondent station, respondent experience at the station, and fire stations’ PMIS implemented on the perception of the fire station about top management support on the extent of uptake of PMIS in disaster management projects in fire stations in Nairobi Metropolis, Kenya.

This study therefore generally concludes that top management support is one of the most critical components of PMIS uptake across all fire stations in disaster management projects. Implementation of top management support factors results in greater uptake of technology-based uptake in disaster management projects in fire stations in Kenya.

Recommendations
Based on the findings and conclusions of the study, the researcher provides the following recommendations aimed at ensuring that the factors of PMIS uptake adopted by fire stations in Kenya plays a positive impact in ensuring improvement levels on the uptake of technology in disaster management projects.

1. The results of this study have helped to determine the crucial factors of PMIS uptake in disaster management projects in fire stations and recommend that fire stations focus on the application of these factors to ensure level of PMIS uptake are successful. In addition, this study recommends that fire stations increasingly recognise the role played by the Key-Staff Involvement, Perceived PMIS Usefulness, and Communication as they are key to achieving the other factors.

2. These findings recommend that fire stations should carefully consider the alignment of PMIS uptake to the disaster management project being implemented and factors of importance consideration so that they support and supplement one another. In addition, it is proposed that in light of these findings, the fire station policy makers evaluate technology adoption practices and levels of uptake of technology and specifically PMIS to ascertain the degree to which they are aligned to the factors of PMIS uptake.

3. From the study it is recommended that scholars and practitioners in project management and disaster management should actively engage in joint research that will be used to assist fire station managers to effectively understand the link between factors of technology uptake and the success of technology uptake in disaster management projects. The academic research will be a foundation in ensuring that there is consistency between the theory of PMIS uptake and its practice. Training institutions including universities and colleges should work together with project management professionals to develop curriculum for teaching students taking disaster management and projects management to ensure a proper link between theory and practice. It should also be made mandatory for students to attend internships or industrial
attachment before they graduate in order to apply the learned theories in class in practical fire station environment. This will ensure that the graduate leaving the training institutions have the pre-requisite orientation skills in technological application in disaster management projects and that the factors of uptake are clear and candid.

REFERENCES


Geist, H. J., & Lambin, E. F. (2002). Proximate causes and underlying driving forces of tropical deforestation: Tropical forests are disappearing as the result of many pressures, both local and regional, acting in various combinations in different geographical locations. *BioScience, 52*(2), 143-150.


Application of Genetic Algorithm in Power System Optimization with Multi-type FACTS

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Abstract- In this era of energy crisis, the power system operators are very much driven to minimize the overall system loss and generation cost. Maximization of network load-ability without compromising the system stability has become a major concern for them. Introduction of FACTS technology can help a system to achieve these goals without building new transmission lines that is both expensive and time consuming. However, the new installation of FACTS in the system has to be optimal in terms of its type, location and size. This paper seeks to present a genetic algorithm based framework that can optimize a system having FACTS devices with an objective of improved economic dispatch. The IEEE 14 & 30 bus systems are taken as illustrative examples to validate the effectiveness of proposed method.

Index Terms- FACTS, Genetic Algorithm, Optimization, Loadability, Economic Dispatch.

I. INTRODUCTION

Problem Statement
The deregulated market model is progressively taking place in power industries all over the world. With such liberalization, a third-party access is provided by separating the generation & transmission of power, and the consumers are empowered to pick from the private utilities as per their own choices for the electricity-buying purpose. However, in order to grab a larger customer-base and survive in the market, these suppliers might cause the commercial rivalry to take an unhealthy turn and resort to the unplanned power exchange through transmission lines. Parallel to restructuring of market, the industry also faces the challenge of satisfying the ever-increasing growth of load demand. All these force to operate some of the transmission lines close to their thermal limits which could result in being overstressed and eventually in congestion. On the other hand, the up gradation of power network by building new infrastructures like transmission lines, substations etc, most of the time, turns out to be not practical due to political, economical & environmental constraints.

Therefore, the general consensus is to have a better utilization of existing network by making it more smart, fault tolerant and self healing. Such maximization of network’s power flow efficiency in terms of decreasing overall loss, cost & instability threats could be realized by introducing power electronics applications like FACTS devices (Flexible Alternating Current Transmission Systems). Proposed by N. Hingorani [1]; this advanced semiconductor technology can provide technical solution to address the following operating challenges, and enhances the useable capacity limits of existing transmission lines by means of numerous control functions like voltage regulation, active-reactive power control, system damping etc, in a fast & effective manner.

FACTS largely depends on whether a suitable type is used in a defined context or not. Moreover, the high investment cost drives the device to be installed optimally in the system rather than arbitrarily. Therefore, the new installation of FACTS must be well-planned in terms of its type, location & rating, and requires an assessment of power system efficiency through off-line simulations. This paper is concerned about developing a robust algorithm which can optimize a system with FACTS devices such that the system load-ability can be increased as much as possible at minimum cost.

FACTS Device Generalities
We know, the power flow in an interconnected network can be represented by the following two relationships.

\[ P_{ij} = \frac{V_i V_j \sin \delta_{ij}}{X_{ij}} \quad \text{and} \quad Q_{ij} = \frac{1}{X_{ij}} (V_i^2 - V_j^2 \cos \delta_{ij}) \]

That means, the network capacity can be increased by acting upon the generator or load bus voltages \( (V_i, V_j) \); transmission line reactance \( (X_{ij}) \); or the angle difference of bus voltages \( (\delta_{ij}) \).

With the ability of of changing apparent impedances of transmission line, FACTS can perform the following controls of active power, reactive power and bus voltage etc. For example, FACTS technology includes devices like TCSC (Thyristor Controlled Series Compensator), SVC (Static VAR Compensator), UPFC (Unified Power Flow Controller), STATCOM (Static Compensator), TCPST (Thyristor Controlled Phase Angle Regulator) etc. Here, TCSC, which consists of an inductance, a capacitance & a simple wire, can directly modifies the line reactance by being capacitive or inductive. On the other hand, the angle \( (\delta_{ij}) \) can be controlled by incorporating quadrature component into bus voltages with the help of TCPST. SVC is the most popular one among the shunt FACTS devices. This compensator got the facility of absorbing as well as generating reactive power in the system. Finally, UPFC is the most versatile device among the FACTS aforementioned. By means of high speed command, it is able to change system parameters like line impedance, phase angle and voltage etc concurrently or selectively.
FACTS technology has also got several other devices that fall into different categories and are developed to serve different purposes. These are not reported here for the sake of length of paper.

**Simulation Tools & Test Bed System**

The IEEE benchmark systems of 14-bus and 30-bus are selected as test bed systems for the simulation of the following research. To carry out the optimization process, an algorithm code is written in visual C++ language. The code is then applied on the system to solve power flow problem with the help of a Matlab based power simulation package called Matpower 4.1 [2].

**Scope of Genetic Algorithm**

As it is known by now that optimal allocation of FACTS is a nonlinear complex problem that involves combinatorial analyses. The inclusion of multiple objectives, existence of both discrete (i.e. locations & types) & continuous (i.e. ratings) domain variables, and apprehension of getting stuck at any of the several local minima available in the search space, etc - all make the problem such complicated that a well-efficient heuristic method like Genetic Algorithm should be employed to solve it in a reasonable computation time. GA is a parallel and global search technique that was developed by J. Holland on the basis of Darwin’s survival of the fittest theory. This technique is ‘intelligent’ in finding optimality since it can evaluate many points simultaneously in the search space, and emulates ‘human reasoning’ while moving from one solution point to other.

**II. PROBLEM FORMULATION**

**Objective Function**

The aim of research is that to increase the system load-ability as much as possible in both steady and transient states of operation by utilizing the maximum benefits of FACTS at minimum cost. Nevertheless, the optimal amount of power flow has to be achieved without compromising any of the network constraints such as bus voltage deviation level, thermal limit of transmission line etc. All these requirements make the allocation of FACTS device a multi-objective optimization problem which involves a non-linear complex formulation comprised of both integer and continuous variables. Mathematically, the following OPF problem can be formulated using an economic saving function that incorporates the generation cost along with the FACTS installation cost as being subjected to the constraints mentioned below.

The first function that deals with the operating cost of generation units in system can be written as a quadratic polynomial:

\[
C_{\text{gen}} = \sum_{i=1}^{i=NG} C_i(P_{Gi})
\]

\[
C_i(P_{Gi}) = a_i P_{Gi}^2 + b_i P_{Gi} + c_i \quad ($/hr)
\]

where, \(a_i, b_i, c_i\) are the generation cost coefficients that represents the measure of loss, fuel cost and other expenses like wages, interest etc respectively. \(P_{Gi}\) simply denotes to the real power generation of \(i\)-th generator whereas NG is the total number of units in the system.

The second cost function is developed from the database of Siemens AG [3] to take the investment on FACTS into account. Such investment includes equipment cost, infrastructure cost and site civil works etc.

\[
C_{\text{FACTS}} = \sum_{j} C_j(S_j)
\]

\[
= \sum \left[ S_j^2 \alpha_{\text{Ftype}} + S_j\beta_{\text{Ftype}} + \gamma_{\text{Ftype}} \right] \quad ($/KVAr)
\]

Here, \(\alpha, \beta, \delta\) are FACTS cost coefficients that differ with the types of FACTS devices (i.e. \(\text{Ftype} = \text{TCSC, SVC, UPFC etc}\)). \(S_j\) is the operating range of FACTS at \(j\)-th location in MVAr. It is basically the difference between reactive power flows before & after inserting the device in the transmission line.

\[
S_j = |Q_{j2} - Q_{j1}|
\]

All the parameter values that involve in these two cost functions are provided in Appendix. The objective function is then determined by adding these functions together. However, before merging the 2 equations, the unit of FACTS cost function also needs to be converted to ($/hr). \[
C'_{\text{FACTS}} = C_{\text{FACTS}} \times \frac{\text{FACTOR } \times 1000}{8760 \times 5} \quad ($/hr)
\]

The following unit conversion formula includes 5 years to be considered as the average device lifetime. This value is selected randomly and does not have any influence on the optimization process as it is applied only to unify the unit. However, technically, FACTS can serve even more than 5 years [4, 5]. Thus the optimization objective becomes as to minimize, \(C_{Total} = C_{\text{Gen}} + C'_{\text{FACTS}}\)

**Fitness Function**

Fitness is a scalar measure of quality that helps in assessing the solutions available in the problem hyperspace and distinguish the most promising ones. It is formed on the basis of objective function. Now genetic algorithm works better in solving the maximization problems rather than the minimization ones as it emulates the nature’s ‘survival of fittest’ principle. Hence, the following minimization problem is transformed into a maximization one by adopting the fitness function stated below.

\[
Y = m C_{\text{Total}} + N
\]

where, \(m\) is a scaling factor which is equal to -1 to convert the minimization problem and \(N\) is a large positive constant to offset the fitness value from being negative. Moreover, in order to avoid slow convergence of algorithm by emphasizing the best solutions in the pool, the ultimate fitness function is derived such that it is normalized into the range 0 to 1.

\[
F = \frac{1}{1 + \frac{1}{Y}} = \frac{N - C_{\text{Total}}}{N - C_{\text{Total}} + 1}
\]

**Search Space Constraints**

The optimization problem is subjected by several constraints that can be categorized broadly into two classes named as equality and inequality constraints. The first of them arises out of the necessity of balancing real and reactive power generation in the system, while the second type characterizes the physical and operational limits of network components along with FACTS devices. Each constraint puts a limit in the search domain and must be satisfied by the solutions in order to be considered as feasible. The solutions that lie beyond these limit-boundaries are infeasible and discarded without having any fitness test.

**Constraint- Number of Device**

Integrating FACTS in a network helps it to decrease the total loss while increasing the stability
margin. Nonetheless, the integration has to be well planned by limiting the number of devices to a certain level so that the new investment required for device-integration remain convenient. Thus the constraint is defined such that a particular solution can recommend to install maximum 4 devices at a time in the system.

\[ 0 \leq N_{\text{FACTS}} \leq 4 \]

Constraint- Types of Device: As it is mentioned before, several FACTS devices has been developed thus far, and it is not practical to incorporate all the technologies in this optimization problem. Depending on the types of compensation, the following research has taken TCSC, SVC and UPFC into consideration. TCSC is selected from the series controller group whereas SVC is a shunt controller. UPFC has got the combination of both series & shunt connections.

Constraint- Possible Location of Device: All the FACTS except SVC can directly be inserted into the transmission lines of the system. The SVC has to be connected at sending bus node, receiving bus or at middle point of line by splitting it into 2 equal parts. Moreover, the generator buses do not need any FACTS and can be omitted from the search space. It is because the voltages of these buses will be regulated automatically by the corresponding generators’ AVRs. For example, there are 20 transmission lines and 9 PQ buses in the selected 14 bus system. Hence, the following constraint for this system can be expressed as:

\[ 1 \leq \lambda_{\text{TCSC}} \leq 20; \ 1 \leq \lambda_{\text{UPFC}} \leq 20; \ 1 \leq \lambda_{\text{SVC}} \leq 9 \]  

Constraint- No. of Device per Line: A particular transmission line should not be occupied by more than 1 FACTS at a time since it will hamper each other’s performance that leads to none of the device working properly [6].

\[ \lambda_i \neq \lambda_j \ \forall i,j \]  

Constraint- Size of Device: The ratings of selected FACTS devices need to be suitable for the steady state operation of the test system. For example, in order to avoid the overcompensation of transmission line, TCSC is permitted to modify the line reactivity up to \( |0.2X_{\text{line}}| \) in inductive mode and \( |0.7X_{\text{line}}| \) in capacitive mode. Similarly, the chosen UPFC can inject maximum 10% of the line voltage by varying its phase angle from -180° to +180°. Finally, a SVC is allowed to absorb or supply maximum 100MVAR reactive power in the system.

\[ -0.7X_{\text{line}} \leq R_{\text{TCSC}} \leq 0.2X_{\text{line}}; \]
\[ -180^\circ \leq R_{\text{UPFC}} \leq 180^\circ; \]
\[ -100\text{MVAR} \leq R_{\text{SVC}} \leq 100\text{MVAR} \]

Constraint- System Power Balance: It is an equality constraint that is imposed on network model to maintain a power balance such that the total load demand and transmission loss must be equal to the active power generated by the online units at each time interval.

\[ \sum_{i=1}^{N_{\text{G}}} P_{\text{gi}} = P_{\text{demand}} + P_{\text{loss}} \]

Constraint- Generator Operational Limit: It is well known that the prime mover imposes maximum & minimum limits on the active power output of a generator. Similarly, the reactive power capability of generator is also constrained as a function of its active power generation. No unit should be dispatched beyond these permissible ranges as given in appendix for the purposes of safety and economy.

\[ P_{\text{lim}} \leq P_{\text{gi}} \leq P_{\text{max}}; \quad Q_{\text{lim}} \leq Q_{\text{gi}} \leq Q_{\text{max}} \]

Constraint- Bus Voltages: Theoretically, the voltage desired at each bus is 1pu. However, practically it never be equals to unity and is permitted to deviate within ±5% of the nominal value.

\[ 0.95pu \leq \mathbf{V}_i \leq 1.05pu; \quad i = 1, 2, ..., N_{\text{bus}} \]

III. ALGORITHM IMPLEMENTATION

Encoding

The implementation of a genetic algorithm initiates by encoding the parameters of the optimization problem into chromosomes (individuals). A chromosome is typically a string which will represent one of many feasible solutions to the problem in the search space. It is very necessary to encode the parameters carefully so that the developed algorithm is able to transfer information between the chromosomes and the objective function efficiently. The elements of a chromosome could be binary bits, real numbers or even other cardinality alphabets. In the following algorithm, binary coded strings are used to represent the chromosomes. Since binary representation has got the minimum no. of alphabets (only 0s & 1s), the manipulation of these binary strings by GA operators become easier.

According to our search space constraints, we can install maximum 4 FACTS devices in the test system, which means each chromosome (solution) consists of 4 strings where each string carries information about a particular FACTS device. Since the configuration of FACTS devices in our case is defined with three parameters such as types, locations & ratings, each string gets three subsets of binary representations. Here, the 1st subset of a string indicate the location of a FACTS, whereas the 2nd & 3rd subsets correspond to its type and rating respectively. Since there are maximum 20 possible locations in the system for installing FACTS (equation 1) and \( 2^4 < 20 < 2^5 \), the number of bits in the 1st subset should be 5. Again, the 3 types of FACTS devices that are taken into consideration to improve the performance of the power system could be encoded as follows: ‘1’ for TCSC, ‘2’ for SVC, & ‘3’ for UPFC. However, a 4th case is also possible which depicts the situation of ‘no FACTS required’, This 4th type of case can also be denoted by some value such as ‘0’. This means we need 2 bits in the 2nd subset to represent the parameter of FACTS-types.

Finally, similar rule (mentioned in equation 3) can also be used to determine the number of bits required for the last subset, which is 8. However, before that, the different ranges of FACTS ratings need to be normalized into a common range, such as -1 to +1. This helps the encoding & decoding of binary strings to be easier.

\[ 2^l \geq \left( \frac{x_{\text{max}} - x_{\text{min}}}{\Delta x} + 1 \right) \]

where \( l \) is the string length to provide \( \Delta x \) variation in accuracy

\[ R_{\text{TCSC}} = \frac{R_{\text{TCSC}}}{0.45}; \quad R_{\text{SVC}} = \frac{R_{\text{SVC}}}{100}; \quad R_{\text{UPFC}} = \frac{R_{\text{UPFC}}}{180} \]

Thus a particular chromosome will consist of total 60 bits to represent all the parameters aforementioned. For example, Table-I shows a random solution to our problem which suggests to

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absorb 56.08MVar reactive power with a SVC at bus 10; shift phase angle by 21.88° through an UPFC at transmission line 4; and change reactance of line 6 by 0.081Ω with a TCSC.

Table I: Representation of FACTS configuration by binary coded string

<table>
<thead>
<tr>
<th>Subset No.</th>
<th>Binary Encoding</th>
<th>Real Value Decoding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10001 10 00111000</td>
<td>SVC of -56.08MVAR @ bus 10</td>
</tr>
<tr>
<td>2</td>
<td>00101 01 10011111</td>
<td>TCSC of 0.081Ω @ Tx line 6</td>
</tr>
<tr>
<td>3</td>
<td>00011 11 10001111</td>
<td>UPFC of 21.88° @ Tx line 4</td>
</tr>
<tr>
<td>4</td>
<td>01101 00 00101100</td>
<td>No FACTS Required @ line 14</td>
</tr>
</tbody>
</table>

Initial Population

Using the strategy described above, an N number of individuals are encoded which comply with the search space constraints. This set of N individuals is regarded as the 1st population set which will evolve from generation to generation with a hope of creating more suitable individuals in future, and eventually converging into a global optimum solution. The advantage of genetic algorithm is that it is not so sensitive to such starting points of the search process for optimum solution. An initial chromosome can be formed by flipping an unbiased coin which has a probability of 0.5. For example, in our case, the coin has to be tossed 60 times in order to get a 60 bits long chromosome. This can be done by calling a random number generating function such as ‘rand’ 60 times in the algorithm code with the help of ‘for’ loop.

However, some care has to be taken while using the loop. For example, the 5 bits allocated for ‘FACTS location’ can produce 2^5 = 32 different values, whereas we have maximum 20 installation sites in the 14 bus system. Thus the algorithm is coded to discard the other 12 values if generated, which can not be assigned to any of these 20 locations. In addition, if a SVC related chromosome includes a generator bus as its location, the location will be changed to the closest load bus (constraint presented in equation 1). Moreover, since a particular transmission line could have only one FACTS at a time (equation 2), each location can appear maximum once in the string of a chromosome, and the later location will be re-randomized if repeated. Lastly, the algorithm is also programmed to discard any identical chromosome that appears twice in the population set. In this way, the entire set of initial population is obtained by repeating the above steps N=20 times as we set there will be 20 individuals born in each generation.

Once the entire population is formed, the real values of parameters are decoded from the binary strings, and introduced in the test system to evaluate the FACTS impacts on the state of power system by invoking Matpower solver. Finally, the fitness of each individual is measured by employing the power flow outputs in the fitness function defined in section II.

Selection

The GA solver keeps expanding its search space by incorporating more and more solutions evolved from the above set of ancestors until a stopping criterion is met. The future offspring will be bred out of a mating pool formed by the fitter candidates of the antecedent population set since the algorithm is inspired by Darwin’s “survival of the fittest” concept. It is a common phenomenon of biological evolution process seen in nature such that the fitter creatures are more likely to survive the competition by yielding better genetic inheritance. Thus the better fitness an individual possesses, the more chances it has to be selected as a genitor in the pool. There are a number of ways that the selection scheme can be implemented in algorithmic form such as Roulette wheel selection, rank selection, Boltzmann selection, steady state selection, tournament selection etc.

This paper adopts the Roulette wheel technique to accomplish the fittest test. To do so, the algorithm is first coded to compute the cumulative probability for each of the 20 individuals by successively adding their probabilities from top to bottom of the current population set. That means the bottom most individual in the set will get a cumulative probability equal to 1.0. Then a random number is let to be generated between 0 to 1, and the individual will be selected according to the range the generated number falls into. This is repeated for 20 times to form the complete mating pool. For example, an i-th chromosome is expected to make \( \frac{\text{Fitness}_i}{\text{Fitness}_{\text{avg}}} \) copies in the pool. The whole process actually mimics the roulette wheel game- ‘All we have to do is spin the ball and grab the individual at the point it stops’. The higher fitness an individual has, the wider area it will occupy in the wheel’s circumference and the more chances the pointer will get to be in that area.

Crossover

After the mating couples are decided, a genetic operator called crossover is employed to inherit the DNA information from the parental genes and rearrange them to produce new offspring solutions for the next population set. The type of such genetic operation could be single, double or uniform depending on the nature of decomposition and recombination. In a double crossover, which is our case, two uniform cross-sites are chosen randomly along the strings of parent individuals. The bits in one parent-individual before & after these cut-points are classified into separate groups, and exchanged with the corresponding groups of the other parent-individual. However, the two cross-sites can not be located at any arbitrary bit-position in the string.

Since the representation of any single device needs a distinct substring of 15 bits, and no decomposition can be done in such a unit domain, the two cross-sites must be defined in the algorithm as

\[
K_1 \in \{1, 16, 31, 46\} \\
K_2 \in \{16, 31, 46, 60\} \\
& K_1 \neq K_2
\]

Now if \((K_1, K_2) = (16, 45)\) is selected for a particular couple, then they will swap the 2nd & 3rd substrings between them while keeping the other 2 substrings unchanged in order to generate new solutions (Table-II).

The algorithm is required to rectify the off-springs time to time as the crossover operation may lead to a problem of having multiple devices in one transmission line. For example, in above case, a solution (offspring 2) is generated that recommends to install a TCSC (3rd substring) at the line no. 6 which has already been occupied by a UPFC (4th substring). Therefore, the new TCSC device will be shifted to a location according to the information of 4th substring available in the other offspring. That means the TCSC device will be relocated at line no. 14 (Table-III). This type of correction process bears the resemblance to the partially matched crossover (PMX) operation [7].
The following algorithm lets the crossover operation to take place with a high probability of \( p_c = 0.9 \). That means there is a certain rate of 10% where no crossover will be performed, and off-spring will be an exact copy of its parents.

The new off-springs are usually expected to be even more novel solutions as they are formed by combining the good substrings from their father and mother nodes who have already passed the competitive selection process. The only matter that needs to be considered here is whether or not an appropriate cross-site is selected. Nevertheless, if good solutions are generated by crossing over, there will be more copies of them in the next mating pool. If good strings are not formed, then they will die out eventually in the subsequent generations through the selection operator. In this way, the algorithm will gradually proceed to find out the optimum solution point.

**Mutation**

After crossover, the newly created individuals sometimes need to undergo the process of mutation. This is required since the new generation nodes might not carry any significant new inheritance information which can lead to a problem of all solutions falling into a local optimum point instead of the global optimum. Population diversity is very much required to search a big part of the search space and incorporate the regions not viewed before by the algorithm.

Mutation operator comes occasionally in action with a low probability of 0.05 ~ 0.1, and alters the bits selected randomly in a string, that is changing '0' to '1' & vice versa. In our case, we let all the four substrings of an individual to be mutated independently and draw new values from the possible set of their parameters. For example, the 2nd & 3rd strings of a random i-th chromosome can be selected for mutation where bit no. 18, 26 & 36 will be altered to add new information to the population (Table-IV).

**Termination**

The newly generated solutions are then reintroduced in the test system for power flow analysis and ranked again according to their fitness behaviour. The new mating pool then comprises of the best solutions generated thus far including both parents and off-springs. So the average fitness of the population will either increase or remain same for the new generation than the previous one. In this way, the algorithm applies the stochastic operators like selection, crossover, mutation etc iteratively to grow the population and completes its ‘exhaustive’ search process. Furthermore, to guarantee the movement all particles over the feasible region, the constraints of section II are applied simultaneously. The generational process continues to repeat until the algorithm converges to a solution that is the global optimum or meets the confidence threshold set by the user. Such threshold could be any fixed number of generations, any high fitness value that has reached a plateau or even exceeding any allocated budget such as computation time etc. The flow chart in figure- 1 depicts how the algorithm processes data step by step.

**Table II: Two point crossover operation**

<table>
<thead>
<tr>
<th>Parent Chromosome 1</th>
<th>100011000111000</th>
<th>001010011000111</th>
<th>000111110001111</th>
<th>011010000101100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent Chromosome 2</td>
<td>100101101101100</td>
<td>010111010011011</td>
<td>010100101101111</td>
<td>001110011010100</td>
</tr>
<tr>
<td>Offspring Chromosome 1</td>
<td>100011000111000</td>
<td>001010011000111</td>
<td>000111110001111</td>
<td>011010000101100</td>
</tr>
<tr>
<td>Offspring Chromosome 2</td>
<td>100101101101100</td>
<td>010111010011011</td>
<td>010100101101111</td>
<td>001110011010100</td>
</tr>
</tbody>
</table>

**Table III: Correction process: rearrangement of FACTS**

<table>
<thead>
<tr>
<th>Offspring Chromosome 1</th>
<th>(No Correction)</th>
<th>10011000111000</th>
<th>100110010110111</th>
<th>011000100111100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offspring Chromosome 2</td>
<td>(Before Correction)</td>
<td>010101010101000</td>
<td>001010110011111</td>
<td>000111110001111</td>
</tr>
<tr>
<td></td>
<td>(After Correction)</td>
<td>010101010101000</td>
<td>010100110011111</td>
<td>000111110001111</td>
</tr>
</tbody>
</table>

**Table IV: Operation of mutation**

<table>
<thead>
<tr>
<th>Offspring Chromosome i</th>
<th>(Before Mutation)</th>
<th>010101001101000</th>
<th>010110100111111</th>
<th>000111110001111</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(After Mutation)</td>
<td>010101001101000</td>
<td>000111110001111</td>
<td>001110011010100</td>
</tr>
</tbody>
</table>

**IV. RESULT ANALYSIS**

The effectiveness of the implemented GA code is tested on the IEEE 14 bus system (Figure- 2). Even though the initial solution matrices took 4 FACTS devices into consideration for installing in the system, the best solution, at the end of iterations, turns out to be installing only one SVC device at bus# 5 with a compensation level of 26.27MVar. Such convergence of algorithm could be endorsed as global optimum solution since it attained the problem-objective successfully, which was defined as minimizing the total loss and generation cost. As it can be observed from Matlab simulation, the following placement of SVC can help the system to save $0.00294 in each MW.
generation (Table-V). The active and reactive power losses will be reduced by 80kW and 220kVAR accordingly. Moreover, the voltage profile also gets enhanced and remains close to unity (Figure- 3). All of these improvements will fortify the loadability and security of the system.

The optimization technique did not prefer UPFC over SVC to address the problem even though the former one is the most powerful & versatile FACTS technology. It was well expected since the objective here was defined in terms of economic criteria, and UPFC is the most expensive device among the three (Figure- 4). The high accuracy level of controlling power and relatively lower cost made SVC the most convenient solution in this case.

An Ant Colony Optimization technique has been reported in [8] to solve the same optimization problem regarding the same 14 bus system. However, the current paper’s approach turns out to be more successful in attaining optimality. It is certain that the improvements that were brought in generation cost reduction & system performance are same in both the papers (i.e. if the values were not rounded). Nevertheless, to do so, the device suggestion in [8] would ask for more FACTS-investment, and eventually longer payback period. For example, in order to bring the following improvements, our suggested solution will cost the system $75.47/hr in a time period of 5 years whereas in case of [8], it is about $76.98/hr. This reinforces our claim about the robustness of genetic algorithm that if the parameters are well tuned in the algorithm, then GA can also solve combinatorial problems efficiently just like other heuristic methods such as PSO, ACO etc.

An optimization is also carried out on the IEEE 30 bus system with the data presented in appendix. The result shows that the optimal configuration of FACTS for this system should be an SVC of 50.06MVAR at bus no. 8. With such FACTS allocation, the system loss and generation cost can be minimized by 10.48% and $0.76/hr accordingly (Table- VI).

### Table V: Power flow results of IEEE 14 bus system

<table>
<thead>
<tr>
<th>System Parameter</th>
<th>Before Optimization</th>
<th>After Optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Generation Capacity</td>
<td>772.4 MW</td>
<td>772.4 MW</td>
</tr>
<tr>
<td>Load Demand</td>
<td>259 MW</td>
<td>259 MW</td>
</tr>
<tr>
<td>Total Power Generated</td>
<td>272.39 MW</td>
<td>272.31 MW</td>
</tr>
<tr>
<td>Total Active Loss</td>
<td>13.39 MW</td>
<td>13.31 MW</td>
</tr>
<tr>
<td>Total Reactive Loss</td>
<td>54.54 MVAR</td>
<td>54.32 MVAR</td>
</tr>
<tr>
<td>Generation Cost ($/MW-hr)</td>
<td>29.99964</td>
<td>29.99670</td>
</tr>
<tr>
<td>Maximum Branch Loss</td>
<td>4.30 MW @line1-2</td>
<td>4.26 MW @line1-2</td>
</tr>
</tbody>
</table>

### Table VI: Power flow results of IEEE 30 bus system

<table>
<thead>
<tr>
<th>System Parameter</th>
<th>Before Optimization</th>
<th>After Optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Generation Capacity</td>
<td>335 MW</td>
<td>335 MW</td>
</tr>
<tr>
<td>Load Demand</td>
<td>189.2 MW</td>
<td>189.2 MW</td>
</tr>
<tr>
<td>Total Power Generated</td>
<td>191.6 MW</td>
<td>191.4 MW</td>
</tr>
<tr>
<td>Total Active Loss</td>
<td>2.448 MW</td>
<td>2.188 MW</td>
</tr>
<tr>
<td>Total Reactive Loss</td>
<td>8.99 MVAR</td>
<td>7.95 MVAR</td>
</tr>
<tr>
<td>Generation Cost ($/hr)</td>
<td>593.441 $/hr</td>
<td>592.682 $/hr</td>
</tr>
<tr>
<td>Maximum Branch Loss</td>
<td>0.29 MW @line2-6</td>
<td>0.25 MW @line2-6</td>
</tr>
</tbody>
</table>
V. CONCLUSION

This work has sought to answer several questions on the behavior of genetic algorithm in solving real world problems like optimal allocation of FACTS devices. The simulation result certifies that the setting of various control parameters such as fitness formulation, selection criteria, mechanisms of crossing over & mutation etc have a strong bearing on the robustness of algorithm.

APPENDICES

Table VII: Generator parameters for IEEE 14 bus system

<table>
<thead>
<tr>
<th>Generator (Bus no.)</th>
<th>Cost Function Coefficients</th>
<th>Active Power Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$a$ ($/MWhr$)</td>
<td>$b$ ($/MWhr$)</td>
</tr>
<tr>
<td>1 (1)</td>
<td>0.0430293</td>
<td>20</td>
</tr>
<tr>
<td>2 (2)</td>
<td>0.25</td>
<td>20</td>
</tr>
<tr>
<td>3 (3)</td>
<td>0.01</td>
<td>40</td>
</tr>
<tr>
<td>4 (6)</td>
<td>0.01</td>
<td>40</td>
</tr>
<tr>
<td>5 (8)</td>
<td>0.01</td>
<td>40</td>
</tr>
</tbody>
</table>

Table VIII: Generator parameters for IEEE 30 bus system

<table>
<thead>
<tr>
<th>Generator (Bus no.)</th>
<th>Cost Function Coefficients</th>
<th>Active Power Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$a$ ($/MWhr$)</td>
<td>$b$ ($/MWhr$)</td>
</tr>
<tr>
<td>1 (1)</td>
<td>0.02</td>
<td>2</td>
</tr>
<tr>
<td>2 (2)</td>
<td>0.0175</td>
<td>1.75</td>
</tr>
<tr>
<td>3 (22)</td>
<td>0.0625</td>
<td>1</td>
</tr>
<tr>
<td>4 (27)</td>
<td>0.00834</td>
<td>3.25</td>
</tr>
<tr>
<td>5 (23)</td>
<td>0.025</td>
<td>3</td>
</tr>
<tr>
<td>6 (13)</td>
<td>0.025</td>
<td>3</td>
</tr>
</tbody>
</table>

Table IX: Coefficients of FACTS cost function

<table>
<thead>
<tr>
<th>FACTS Type</th>
<th>Cost Function Coefficients</th>
<th>$\alpha$</th>
<th>$\beta$</th>
<th>$\gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCSC</td>
<td>0.0015</td>
<td>-0.7130</td>
<td>153.75</td>
<td></td>
</tr>
<tr>
<td>SVC</td>
<td>0.0003</td>
<td>-0.3051</td>
<td>127.38</td>
<td></td>
</tr>
<tr>
<td>UPFC</td>
<td>0.0003</td>
<td>-0.2691</td>
<td>188.22</td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES


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The basic constituents of tourism in Libya

Walid Said
PhD Candidate

Abstract: Man has, from ancient times, exercised tourism by means of quasi continuous movement in search for better living abodes whereas movement is considered one of the human characteristics. Since its early life, man got used to movement from one place to the other to seek after, in the first place, livelihood, and then try hard to realize the mental and intellectual delight. But regarding the reference to the word tourism, this term expresses a term used in the Latin languages. In the linguistic concept of the term tourism, we find that it means wandering and the term touring the land means he went and moved along the surface of the earth.¹

Key words: tourism, life, livelihood, earth

I. INTRODUCTION

Libya is distinguished by its strategic site of the tourism state as of the site, space, disparity of climate and reliefs as well as the number of inhabitants.² Libya is an excellent and important site within the Mediterranean basin group which is considered one of the more attractive countries of the world for the world tourism and for its closeness to the European continent which absorbs about 65% of the volume of the international tourism flow, in addition to its distinguished site in North Africa, in the center of the Eastern and Western Arabic countries. It is considered like the gate of Africa, where prevails the Mediterranean Sea climate, a moderate climate, particularly the regions located in the northern sides of the country. There is also a desertic climate (hot climate) in the southern regions. The areas located between the north and the south are influenced by these two climates and in general, the climate of Jamahiriya is considered a moderate climate in most of the days and seasons of the year, the matter that helps in extending tourism season in summer and winter. As of the reliefs, they are divided into several areas, including the coastal that is stretched out to the Mediterranean Sea by a distance of about 2000 km. they vary by the sandy shores, gulfs, mountains as well as the plains and perhaps the most significant is Sahl Jefara region whose area or surface is 8000 km and it is a fertile arable plain, having some valleys such as Kaam Valley and Almagnin Valley and several mountainous cultivated areas over the whole country such as Nafussa Mountains in the western area and the Green Mountain. They mean the extent of availability of real reasons to motivate human beings in order to visit a place with the exclusion of another for the purpose of tourism and it is a multi-dimensional and multi-aspects concept. As we have previously mentioned, tourism industry represents a significant source of national income for several developed and underdeveloped countries of the world. If the tourism sector is significant for many countries, it is necessary for it to be more significant to the countries that are endowed with a wide space in order to realize the exemplar independence of its available tourism sources and Libya is considered one of the countries that remained away from the achievement of any progress in this field in the past, the matter that has weakened the significant role of the tourism sector and maintained reliance on the oil sector as the main national income source. Departing from the intention to develop this field and grow it, it is necessary to know the basic constituents of tourism in Libya and the most important obstacles that stand in the way of progress. In this field, the most significant tourism constituents in Libya may be divided into the following:

¹ Maher Abdulaziz, Tourism Industry, Applied Sciences University, Zahra House for Publication & Distribution, 1997, T2, P. 331
² Importance of tourism and its impact in the diversity of sources of income in the Libyan Jamahiriya, Master degree thesis in Economics, Alsadeq Mohamed Alfalfaz, year 2000, P. 122, Academy of Postgraduate Studies, Tripoli - Libya

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- Natural resources / they are meant by all that characterize the tourism areas in Libya as of site, weather, climate, geographic nature, surface, waters, vegetal life, animal life, development and other natural resources.
- Weather and climate/ weather represents the description of temperatures, air pressure, speed of wind, humidity, rains, plants and forests. But climate expresses the long changes in weather cases.
- Geographic nature of the tourism area/ it is represented in a group of reliefs that characterize the tourism area as of mountains, rivers, sea, valleys, rocks and deserts. There are in Libya several tourism areas in the center and south of Libya as well as lakes in the heart of the desert. Besides, there is the longest coast over the sea. It is distinguished by a seacoast of 2000 km long which may very possibly be exploited in tourism.

II. OBJECTIVES OF TOURISM SECTOR IN LIBYA

Libya sets its hopes on the role that may be played by the tourism sector in diversifying the national sources of income within the next period by means of laying out plans that aim at taking care and develop the numerous tourism areas represented in the historic antiquities and sandy seashores in addition to the warm atmosphere which inspires tourism. For this end, Libya has made good progress in providing the necessary requirements and facilitations as of hotels, tourism villages, recreations and other establishments in support for the development of this sector and its growth. The following are among the objectives attempted to be realized by the tourism sector in Libya:

A) At the short range, make the world be acquainted with Libya and the tourism, natural and industrial resources it is endowed with as well as the significant achievements realized in various economic and social sectors. Work for the sake of local growth of the tourism sector in order to realize an integral growth at the level of the country

B) At the long range, working towards raising the level of contribution of tourism sector in the realization of the economic and social development through:

- Provide work opportunities for a great number of citizens
- Consolidation of the national income with respect to foreign currencies
- Encourage investment in tourism sector, particularly the growth of projects and the medium establishments in the tourism sector in such a way to realize development in this sector internally and externally.

Problems facing tourism in Libya

Problems such as inefficient resource allocation, poor infrastructure, and frequent policy reversals, in addition to the UN (United Nation) international embargo which has been recently lifted, are major reasons for the delay and observed slow tourism development. The UN international embargo has been a major deterrent for tourists. It has resulted in delay in tourism development and made it difficult for tourists, who have instead had to travel through an arduous, physically exhausting road into and out of the country through the Tunisia-Libya land border. Despite the fact that Libya possesses a splendid variety of tourist attractions (natural, historical and cultural), the problems facing the tourism sector and the development of tourism activities in Libya are several and each needs to be considered carefully in order to formulate the right policy to tackle them.
These problems can be summarized as follows:

- Lack of tourism-related infrastructure

The sufficient infrastructure necessary for the development of a successful tourism sector is lacking. Most important amongst these, is that there is a lack of available accommodation in terms of both quantity and quality close by the principal attractions such as, classical archaeological sites, selected coastal areas and convenient desert stopover points suitable for international tourists. The facilities regarding the presentation of some attractions is not wholly adequate for visitation by tourists in aspects such as, lack of road signposting and informative signposting at places of interest that are in language other than Arabic, inadequate road maps of Libya as well as detailed ones for the principal towns and cities, beside that the need to improve the existing information centers at the site areas and establishing some more all over the country. In addition, despite the large number of restaurants, there are only a few that are of an acceptable standard to international tourists. Besides that, there is little or no entertainment or cultural activities organized for presentation to visitors. In addition, the availability of Libyan souvenirs and handicrafts in general, and those of unique quality in particular, is poor. Consequently, the shortages of these facilities will definitely have its impact on the level of tourist demand.

The visa entrance system might be another deterrent for international tourists, as well as the fact that the official currency exchange rate for the Libyan dinar is at a high level, which results in uncompetitive prices for tourist related services such as accommodation and transportation, compared with neighboring countries. Moreover, tourist accommodation in some tourist areas is not up to standard to meet international tourist market requirements and there is a lack of tourist information centers. Also, the poor communications between the travel trade in the international tourist market and Libya has resulted in an absence of awareness and knowledge in the tourist generating markets of Libya’s tourism resources and attractions.

Lack of awareness and image

Beside the severe lack of tourism infrastructure, there is a lack of awareness and image of Libya as a tourist destination among international tourist markets. The promotional tools, which are presently employed by, GBT (General Board of Tourism) and local tour-operating companies are insufficient. Therefore, the need for more effective promotional campaign has become essential in order to change the negative image of the country as a tourist destination that has been held in the outside world and particularly European tourist markets resulting from western media in the last couple of years.

Lack of competent human resources

The tourism industry is a labour-intensive service industry dependent for survival and competitive advantage on the availability of good quality personnel to deliver, operate and manage the tourist product. The interaction between tourist and tourism industry personnel is an integral part of the total tourist experience (Amoah and Baum, 1997). According to HCTC (1995), tourism and hospitality have one of the highest levels of skill shortages (cited by Jameson, 2000), and Libya no exception. In Libya, tourism related services have a lack of good quality personnel. Therefore, there is an urgent need to develop human resources, particularly indigenous personnel, for delivering quality services for tourists, as well as enhancing general skills of the local workforce. All hotels and beach resorts should be staffed with skilled managers and technical services personnel to be more familiar with customer’s needs and wants, help them and handle their enquiries and complaints as well as to meet an international standard of skills. As the industry
continues to develop and managerial roles and companies become more complex, the nature of the unit management role will increasingly require the skills and knowledge that education and training bring.

Despite the lack of the abovementioned factors, tourism in Libya faces a number of opportunities, which it should fully exploit in order to sustain and accelerate tourism development in the country. In order to achieve accelerated tourism development the following key factors and priorities should be considered:

**A) Government and community involvement**

Government involvement in developing countries including Libya has become essential especially in the initial stages of tourism development. The industry could not survive without them. Governments have the power to provide the political stability, security and the financial framework which tourism requires. They provide essential services and basic infrastructure. Finance represents a core factor for any business. In the Libyan case, in order to utilize its extensive and varied range of tourism resources (natural and man-made) effectively, increased finance should be allocated for tourism in the country’s national economic strategy. The public and the private sector cooperation and collaboration play a vital role in the development of the sector. If tourism is to flourish more widely across the country to reap the socio-economic and environmental benefits, government commitment with increased budget for the tourism development is essential as, obviously, without budget and estate commitment, tourism will never develop.

In Libya, residents should be a central component of tourism plans (unlike what has been experienced in several tourist destinations) and should be remembered not just in post-plan implementation. They should be aware of the economic benefits of tourism development to their community and should perceive the positive changes in their communities from tourism with aspects such as changes in living standards, investment, level of income, employment opportunities, and recreational facilities for residents, tourism as a source of valuable experience and preservation of antiquities and public facilities etc.

This all could lead to good tourist-host interrelationships, which results in better interaction between local people and tourists. This would encourage both parties to care more about the community’s tourist assets, which in return leads to more sustainable tourist assets.

**B) Sufficient budget and action plans**

An adequate budget for funding tourism projects and implementing tourism plans is an important factor for accomplishing successful tourism growth. Some tourism development plans were prepared to further tourism in the country. However, non-implementation of these plans mainly due to insufficient budget, in addition to some other reasons, was a major drawback to accelerate tourism development. Therefore, in order to achieve tourism growth in the country the government involvement and commitment became essential to overcome any financial problems concerning the development of the tourism sector, which should be combined with an effective controlling system.

According to Clayton (2003), in a situation of external shocks, mismanagement, corruption or some combination of these factors, which may lead to significant unproductive over spending, without commensurate or growth, this usually requires governments to get their budgets back under control. In addition, the establishment of a tourism development bank is recommended to
enhance tourism growth in the country. Action plans are required to take immediate action towards the establishment of tourism-related infrastructure. The aim of planning for tourism is to identify major issues that are likely to affect the development and management of tourism as well as to develop policies and programmes to assist in making the industry more viable and sustainable. Many have argued that, in order to achieve integrated and sustainable development, the macro level of economic and development policy must incorporate social and environmental factors at the outset of planning (Clayton, 2003).

Tourism in Libya is included in the national plans, but the resources are not allocated to achieve the sector's goals. The delay in the execution of tourism plans in the given time has been a major problem in the slow growth of tourism in the country. Therefore, the provision of necessary requirements, such as sufficient capital with an effective controlling system to avoid corruption, in addition to the provision of good expertise, flexibility etc to allow the completion of the projects, have became crucially urgent and important.

Wall, (2005) added that, in developing countries, there is continued emphasis on master plans which are often made by external consultants, who usually come from developed countries, where there has been a shift in the emphasis on tourism master plans for larger areas. Those external consultants often do not undertake such tasks in their places of origin. In fact, such master plans are designed to attract external investors by ensuring potential developers that there is a broad vision for the destination area and that their investments are desired and secure. Therefore, action plans are required, to accomplish positive results. Plans for the tourism sector should not be considered in isolation. As tourism is an interdependent sector, plans for tourism should be integrated with other sector plans. Problems arise when development is rushed, with little consideration for the environment. Therefore, the socio-economic and environment fabric of the country should be carefully considered in order to achieve sustainable tourism development.

III. DEVELOPMENT OF TOURISM IN LIBYA

Tourism planning and development authorities with a well-developed institutional framework at various levels (federal, provincial and local) are required to manage the existing resources to meet the tourist market demand. A fully provisioned marketing section with competent professionals is the most important need for the country to introduce its assets in the tourist market and to the travel trade. As a result, the formulation of marketing plans which are missing in most of the Libyan tourist enterprises, due to the lack of expertise, have become essential for the co-ordination of marketing activities. The marketing plan basically should have objectives/targets, strategy (utilization of tourist marketing mix), time limits, budgets and controls.

IV. INVESTMENT IN TOURISM

Investment in tourism infrastructure must be addressed as soon as possible as it is a core factor for tourism development. This cannot be achieved unless the provision of physical infrastructure is completed. Developing a new tourism-related product or service, requires intensified efforts at the initial stages in order to gain an adequate proportion of the international tourist market share and then to maintain this position in the medium to long-run. In Libya, where tourism is viewed as an economic alternative for gaining economic growth, the government should make investment as easy as possible for prospective investors.

Consequently, this could lead to an increase in the tourism market share and enable Libya to compete more effectively. Sufficient funding, and establishing an appropriate atmosphere for investors that might boost confidence among them, is required to
encourage local and foreign investment to invest in tourism related services by treating tourism investment legislation as a special and more distinctive case in order to be more attractive. This might take the form of exempting both domestic and international components from tax for a certain period of time in the full investment.

The development of more tourist accommodation such as small and medium-sized hotels, beach resorts, roadside travel-lodges and guest houses to meet the demand of prospective international and domestic tourists at a competitive price and more—value for-money—facilities could lead to sustainable tourism development and fast promotion of the country as a tourist destination. Similar investment policies in the oil sector which has been very successful could be adopted for investment for Libya’s tourism industry. Encouraging foreign investment (renowned companies in particular) to invest in tourism-related services, could generate employment for Libyans and bring in the highest technology and experience.

V. MARKETING ACTIVITIES

The need for marketing activities, which Libya is currently lacking, represents a core factor for achieving tourism growth in the country. In addition to awareness and knowledge about the tourist product and improving the image of Libya as a tourist destination among international tourist markets, marketing plays a vital role in understanding the needs and desire of the actual and potential customers. Help in responding quickly to tourist markets, changing conditions, offering the country’s tourist product in a more attractive way than its competitors as well as portraying the diversity of the Libyan tourist product in terms of society and culture, history and heritage while targeting specific segments related to individual types of activity or pursuit. In order to increase the awareness and image of Libya as a tourist destination, it is proposed that a foreign tourist office should be established in major tourist generating countries.

As a cost saving device or interim step, the London office for example, should be responsible for some other countries in the European Union. In the long run it will be essential to have an office in the USA, which would also serve Canada. The importance of a destination having a foreign office lies in it is ability to help travel agencies in a tourist generating country to influence the choice of the destination in various ways. Furthermore, the need for a foreign office becomes more crucial when it is considered that travel agencies handle about 70% of travel business.

Education and training

Education and training is required for enhancing the skills of those working at all levels in the tourism industry, which is critical to its future prosperity. Training should be performed in a wide range of skills, including management and information technology. The industry needs skilled managers and staff who are capable to identify and meet the needs of international visitors.

Training facilities should be provided at university level to produce better educational programmes directed towards planning, developing, development and management of tourism. Beside the formal education system, informal training, either on-the-job or through programmes should be carefully tailored to meet defined objectives and targeted at specific types of individuals.

Foreign expertise to train tourism personnel on specific aspects, should be organised by the public and the private sectors to provide a base for future education and training and to improve the standards. The tourism training institutions in Libya have
formulated educational and training programmes for the industry but at this stage they lack both efficiency and sufficiency. As a matter of a fact, it will take a long-term sustained effort for the industry to adapt to the view that effective human resources development is critical to business performance. Moreover, education helps change people’s perceptions towards tourism and raises their awareness of the opportunities and challenges involved in tourism.

Tourism training institutes and centers

The regular training is available in the sector in six training centers which are distributed over the various Libyan areas: Janzour (Tripoli), Misurata centers, Benghazi, Shahat, Soussa besides the University of Derna which organizes a training program before graduation. These centers consist of institutes for tourism and hotel professions. Curricula were determined for them in the past by the Scientific Research Center affiliated to the General People’s Committee for Education and this curriculum used to be its’ main source which is the Jordanian curriculum by 70% and every institute provides the same group of training courses in spite of the presence of a great independence in the manner of presenting them to the students. The technical study books are not available at present in any of the institutes.

There are two independent departments in Tripoli Janzour Institute whereas the first department is concerned with the intermediate stage and the second department is concerned with the high stage and the main subjects in both programs are the production of foodstuffs and the offering of food, housing, reception and the household management. Three groups have completed the intermediate program, about 400 students, and the absorption of about 300 students in the intermediate stage and about 250 students in the high stage and whereas work has started in the stage since 1995 and then the first batch of it has graduated on 1998 and the total number of teachers has reached 47 teaches in addition to the technical study subjects (hotel) where foreign languages shall be taught as well as some general subjects. Also, contacts has been launched with a number of institutes outside Libya financed by the People’s Committee of Education so that invitations shall be directed from time to time to some international institutes in order to organize study courses, particularly in the field of tourism.

Misurata institute has been founded on 1992 and involves two departments as follows: the intermediate and high stages and study begun in this institute on 1996. The number of students in the intermediate stage has reached 265 students and the number of students in the high stage has reached 61 students and the members of the teaching staff in the institute attain 25 teachers among them 5 teachers from the national elements and the remaining from the Arab Republic of Egypt, Kingdom of Jordan, Iraq and Palestine.

Students in the intermediate stage exercise specialization in the field of hotel businesses while the students in the high stage continue their studies in the field of hotel and tourism in a more thorough way while Misurata Institute and Tripoli Institute are specialized in the methodology and philosophy related to practical training within and outside the institute because the policy of Misurata Institute is not to undertake the practical training within the institute, yet, it has taken official measures with the local hotels in order to practice the practical training therein and a return shall be paid to the students against the period they spent in the hotels, the matter that represent an extra incentive to them.

Soussa institute is located in an old administrative building and has been inaugurated on 1997. It is unlike the other institutes because it provides the high study courses not the intermediate and the number of students who joined it has attained 260 students distributed between the tourism and hotel activities with the presence of 14 members of the teaching staff, most of them are
expatriates and all the plans of this institute are an operation of courses and drills that take place within the medium and big hotels only, of two-years duration.

The manner through which a strategy for the promotion of the manpower operating in the sector of tourism may be conceived according to what is reported in the Quinquennial plan issued by the General People’s Committee for Tourism in accordance with the following:

- Create an educational culture by means of (the values, conducts and the integral training for the development of businesses and the spread of the best modern scientific methods and ways for tourism and the tourism training.

- Strengthening the professional levels (professional awareness – training, professional promotion)

  Administrative promotion and concern for the professional qualifications in this field. Promotion of the quality of training by means of the convenience of potentialities for the national necessities and improvement of means attainment and uplifting by the various training means and types, upgrade the quality standard by the trainers by developing the training program.  

  **Conserving tourism environment**

  Conserving the natural and built tourist resources for future generations against any environmental damage will lead to long-term tourism development. Management of the natural and built resources and tourism planning should be directed towards quality as well as growth. In this context the level of management should be improved and staffed with competent personnel. The development of tourism should be linked to other sectors of the economy, if it is to stimulate production in agriculture and industry that will contribute to the development of a more balanced economy and reduce the percentage of foreign exchange leakage.

  In order to suit the needs of long range development of the tourism sector and to solve its problems, management planning is essential to know the positive and negative effects of tourism on the environment with a view to preventing environmental degradation. Problems start to emerge when development is rushed, with little consideration for the environment. The extra volume of visitors arriving at particular destinations causes most of the damage done to the environment as a result of tourism. These destinations are likely to be affected by congestion, smoke, ecological disruption, land use pollution etc.

  As a result, for Libya to attain sustainable tourism development, it is crucial to consider environmental issues as a key factor in the overall development of the tourism sector. Distinctive investment incentives to local and foreign investors could help to conserve the natural and built environment. In addition, it is apparent that successful tourism planning requires the involvement and participation of residents in the destination areas. Interaction between tourists and residents plays an important role in conserving the local environment. This could be attained, by developing a tourism product that makes the visitor care about and feel for the local environment.

**Diversification of tourism product**

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3 Teysir Ali Sassi, role of the human resources in the development of tourism sector in Libya, Master degree thesis 2005, P. 105, Academy of Postgraduate Studies T1

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Moreover, diversification of tourism products becomes a necessity as modern tourism activity has shown a growing tendency towards it. Keeping pace with the rapidly changing and complex requirements of tourists in a highly competitive international tourist market and allowing the emergence of new tourist destinations cannot be achieved without tourism product diversification combined with a high standard of tourist services and facilities for the presentation of those tourism products.

The image of Libya as a tourist destination is entirely based on historical places, desert and culture. In other words, the image of the country in the viewpoint of tourists is as a cultural destination. Therefore, the opportunity for diversifying the tourist product exists. Libya can become one of the best sea, sand and sun destinations in the world, which requires heavy investment in beach resorts, hotels and sea sport facilities.

Moreover, many other tourism resources such as business tourism, scuba-diving, spa tourism, wildlife, mountain trekking, marine-based activities (e.g. game fishing, flotilla sailing) and fairs tourism are not fully exploited due to the lack of tourism services and facilities, which could play a significant role in diversifying the country’s tourism products. Those tourism resources might be helpful for Libya both in the short and long-term and could create more leisure and construction activities for other areas apart from the capital which may create community well being and encourage settlement of people in rural areas who would otherwise prefer the urban areas for job seeking purposes.

The major objective of developing international tourism in all countries is to increase foreign exchange, which aims to increase the number of tourists and prolong their length of stay. According to a survey, which has been conducted with international tourists visiting Libya, the length of stay of these visitors is relatively short. In order to encourage visitors to prolong their length of stay, diversification of the tourist product has become a necessity. Extending opportunities for visitors to consume can be encouraged by offering intensive tours programmes and more convenient and preferential treatment for tourists, such as tax-free shopping, convenient payment systems (credit card machines etc), the provision of proper shopping facilities for incoming tourists, and the development of unique souvenirs and gifts which are warmly received by visitors.

Conferences and conventions tourism is a major economic activity in most developed countries. After the lifting of UN sanctions on Libya, many foreign companies came forward seeking investment in various sectors. This encourages the opportunity to conduct conferences and conventions, which require sufficient congress halls and facilities offered by hotels in Libya. Conferences organizational skills and event development knowledge are required to channel the market.

The necessity of developing convention tourism in Libya should be recognized because of the following factors: This specific tourist market yields large financial benefits; it helps to extend the tourist season the whole year round; it can be an opportunity for special promotion and advertisement for Libya as a tourist destination; it gives an opportunity to the participants to experience various tourist products of the country, therefore, raising the possibilities of coming back as ordinary tourists as well as conveying the message to their friends and relatives (word of-mouth).

Continuous improvement

Continuous improvement is needed, as Libya may face increased tourist demand in the future. Whether the Libyan tourist market will be able to meet and take advantage of this increased demand will depend on how various tourism organisations both
public and private cope with the problems in the present and take the necessary steps to meet the challenges of the future. Three important aspects should be considered carefully to achieve sustainable tourism development: The product’s life cycle, the socio-economy and the environment. Problems arise when development is rushed taking little or no consideration of these three aspects. These development problems can be resolved, by responsive tourism planning as well as by the government and industry working towards sustainability. In addition, to remain competitive in the tourist market place, new products or concepts need to be developed.

The effort of Libya’s General Board of Tourism (GBT) and other tourism organisations in the country should focus on the development of the quality of the tourism product and services. In addition, all tourism projects should have the appropriate capacity and the range of facilities that will allow their coexistence without affecting the natural, historical, social, cultural and economic environment. Consequently, the greater tourism attraction of Libya will be preserved for posterity, and holidaymakers may continue to enjoy activity-based leisure time both in and out of season. For achieving successful and sustainable tourism development, in addition to related-tourism infrastructure and tourism product diversification, Libyan tourism needs continued improvement in marketing activities and training in order to meet the continually changing tourism market demand.

Marketing and promotional activities will be indispensable if Libyan tourism is to survive the keen competition of established and emerging tourist-receiving countries. Finally, it may be said that Libyan tourism will not achieve any improvement unless an adequate budget is devoted to tourism plans and marketing activities. Moreover, a product that works in harmony with the environment remains successful for much longer as well as generating income for both the public and private sectors.

VI. CONCLUSION

International tourism movement in Libya has suffered because several internal and external problems which contributed in the retardation of this sector which negatively affected its contribution in the economic and social development of the Libyan society. The problems were represented in several problems including the negligence by the state of the growth and development of this sector for a long period of time, which resulted in the decrease of the tourism awareness or consciousness at both official and public levels because of the inexistence of institutions and experienced human cadres who are able to run and manage this sector and consolidate it within the Libyan society. They were also represented in the decrease of the level of tourism services which were considered to be among the most significant elements upon which depends the tourism industry whereas they play a significant role in enabling the tourists to enjoy their tours or flights and lengthen the duration of their stay. It appeared from the remark and observation and from the tourists’ opinion surveys that the level of services whether in the lodging utilities or the communications means or drinking water, food or entertainment and amusement means or health services has ranged in majority from low to medium. Also missing in some civil life basics such as unavailability of daily newspapers and journals in foreign languages is also evident. Also, the retardation of tourism transportation means and their unfulfilment to the tourists’ requirements whether in terms of comfort or punctuality is also evident in addition to the problem of civil aviation which the country was deprived of for a long period of time because of the sieges’ circumstances. Besides the bad local and international telecommunications which stand as an obstacle before any achievement for the tourism companies to work with efficiency and also before the international communications of tourists with their relatives or work sites and in addition to these problems, the problem of the administrative complexities and difficulty to obtain entry visas to the country in one hand and the problems of waiting at the frontier or border which is not equipped with comfort means for long period of time, the matter that makes the journey or flight unpleasant and repulsive. Moreover, the obvious negligence which spoils the
tourism sanctuaries and historic museums unequipped with necessary comfort means or with tourism booklets and maps besides the fewness of specialized tourism guides.

These factors combined shall not make of Libya a desired tourism destination; the matter that reflected on the littleness of tourism groups and their hesitation for a long period of time whose average has reached about 58 thousand tourists over thirty years. The tourism statistics refer to the fact that these tourism groups are in continuous decrease whereas they reached on 1998 about 20 thousand tourists. If the conditions and problems that prevailed during the nineties of the last century continued persist, including the air embargo, the numbers of tourists shall continue to regress during the first fifteen years of the current century and it is expected that the numbers of tourists shall reach about 1000 tourists on 2019.

References

2- Hana Hamid Zahran, Culture and Tourism Development Programs, world of books for publication and distribution, Cairo, 2004.
6- Kamel Sayed Ghrab, Strategic Management, King Saud University, Saudi, 2007
10- Global Tourism Forecasts to the Year 2000 and Beyond — Executive Sumary, WTO, 1995.

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PATIENT FACTORS INFLUENCING ADHERENCE TO ANTI-TUBERCULOSIS MEDICATION IN NJORO SUB COUNTY HOSPITAL, NAKURU COUNTY, KENYA


Abstract: Background of the study: Tuberculosis proves to be one of the most serious infections of the world with over 8.6m infections and 1.3m deaths recorded annually. Kenya is one of the 22 high TB burden countries and is ranked 13th according to the World Health Organization (WHO). The cost of treatment of tuberculosis is going up due to the emergent of drug resistant strains of mycobacterium tuberculosis. Multi drug resistant tuberculosis (MDR) and extensive drug resistant tuberculosis (XDR) are a complication of poor adherence to anti-tuberculosis medication. Despite several efforts to reduce worldwide prevalence of TB various factors hamper these efforts. One of the prominent factors affecting TB is adherence to anti-TB medication which is determined by several factors including drug availability, side effects, and cost associated to treatment and patient provider relationship. The aim of this study was to identify patient factors which influence adherence to anti-TB treatment among TB patients at Njoro Sub County Hospital.

Material and Methods: A cross-sectional analytical study design was adopted where a total of 25 which is 25% of total registered TB patients at Njoro Sub County Hospital was calculated using Cohen and Manion(2006) hypothesis that states that selection of at least a quarter of the sampling units is sufficient for the study of social science in nature. Questionnaires were used to collect data. A pilot test was done to validate the questionnaire’s suitability. Descriptive analysis was done to analyze data.

Results: Of the 25 patients analyzed, 8 (32%) had interrupted treatment. Out of the 8 clients, 2 (25%) missed one visit; 4 (50%) missed two visits; 1 client (12.5%) missed three visits and another 1 (12.5%) missed four visits. Majority of clients misses at least two visits before coming back for treatment.

In conclusion: The study shows that about a quarter of patients in TB treatment program will at one point miss some pills either due to Conflict with work schedule, poor relationship between patients and Health Care Providers and alcoholic.

In recommendations: There is need for proper counseling of TB patients on drug side effects, agree on treatment plans based on work schedule, reduction on alcohol intake while on TB treatment and initiation of good relationship between the healthcare provider and the client. This will enhance adherence during the period of treatment.

INTRODUCTION AND LITERATURE REVIEW

Tuberculosis (TB) is a chronic disease which occurs in both tropical and temperate climates caused by Mycobacterium tuberculosis (MTB), a bacilli first identified by a German scientist Robert Koch on March 24, 1882. Other Mycobacterium species like M. bovis, M.africanum, M. microti, M.caprae M. canetti and M. pinnipedii can also infect humans and cause TB Raviglione et al, (2001).

In 2012 TB infected 8.6m people which resulted to 1.3 million deaths throughout the world (WHO, 2013). TB is transmitted through droplet infection from a simple cough, when an uninfected person inhales air contaminated by the tubercle bacilli Raviglione et al, (2001). TB infection is more common in resource-limited countries with high HIV infection rates co-existing with low social economic status.

Africa is facing the heaviest TB burden in the world. Despite implementing the internationally recommended Directly Observed Therapy Short course (DOTS) strategy, the African region continues to contribute a high proportion of the global TB burden. Of the
22 high burden countries responsible for 80.0% of the total global burden of TB, nine countries are in the African region. Thirteen of the 15 countries with the highest estimated TB incidence rates in the world are found in Africa (WHO, 2009). The lack of infrastructure compounded by the higher HIV prevalence in the African region, contributes to Africa’s high TB burden. Patients’ limited healthcare seeking behaviours and shortages of healthcare professionals in the region contribute to the high TB prevalence rates in the region Richard E. et al, (2008)

Various global efforts have been initiated to control TB including declaration of TB as major global public health problem by the World Health Assembly (WHA) in 1991. This prompted setting of targets for diagnosis and treatment of TB by the year 2000 but the targets were not fully met. The WHA planned to detect 70.0% of smear positive TB cases and to successfully treat 85.0% of smear positive TB cases detected by the year 2000 (WHO, 2009). But the targets were not achieved by the year 2000. Later in the year 2000 the Stop TB partnership the targets of the WHA at 70.0% detection of smear positive TB cases and to successfully treat 85.0% of smear-positive TB cases by the year 2005 through the DOTS programme was launched in 1994 (WHO, 2013). The case detection rate was met in 74 countries and in two regions – the Americas (73.0%) and the Western Pacific region (77.0%). TB case detection and treatment success rates were 47.0% and 75.0% respectively for Africa during 2007 (WHO, 2009).

In Kenya, there has been a steady increase in the number of tuberculosis patients particularly since the early 90’s. This rising number of tuberculosis cases poses a major threat to the health and economy of this country. The case notification rate has steadily increased from 54 per 100,000 in 1991 to 326 per 100,000 in 2009. The total number of notified cases in 2010 was 106,083 (TB-CARE, 2013). WHO estimates that in Kenya only 80% of TB cases are detected, indicating that the remaining 20% undetected cases continue to transmit TB (WHO, 2010). This increasing number of TB cases is thought to be largely associated with the growing HIV epidemic (WHO, 2010). Tuberculosis treatment success rate for the 2009 cohort is 85.5% for new smear positive pulmonary TB cases (n = 37,402). Kenya attained the global TB control targets (70/85) in 2007. Kenya has witnessed a marginal 2% decline in TB cases. The peak age group for TB infection for both males and females in 2012 was 25-34, the economically productive and sexually active age group with a male to female ratio of 1.4.

TB is the leading cause of mortality and morbidity in persons with HIV/AIDS. It has been reported that one of every three person who dies of AIDS is due to TB infection (UNAIDS, 2009). In 2009, the HIV sero-positive prevalence among the tuberculosis patients was 44%. The numbers of TB cases have stabilized and continue to steadily decline.

Just like many other chronic diseases unsatisfactory patient compliance with medication is a challenge for TB patients (Addington, 1979). Majority of TB patients started on TB treatment do not complete their treatment leading to prolonged infectiousness, relapses, drug resistance and death Munro et al, (2007). Patients who fail to complete the standard course of treatment may develop Multi (MDR-TB) and extensively drug resistant TB (XDR-TB). This situation jeopardizes the prevention and control strategy of TB, especially in developing countries, where there are high rates of HIV, poor housing, poor nutrition, poor access to quality health care, stigma and poor social economic status. This in turn increases the rates of tubercle bacilli transmission in the communities and result in more cases of full-blown TB compliance to TB treatment continues to be one of the major obstacles that TB control programmes worldwide have to deal with, especially in developing countries (Tessema, Muche, Bekele, Reissig, Emmrich & sack 2009:20) thus understanding patient compliance to treatment in NJORO could help tackle issues to improve compliance to treatment and health outcomes at large.

The study targeted patients undergoing treatment for tuberculosis in a bid to find out the healthcare factors that affect patient adherence towards anti-TB medication.
2.1 Adherence
Successful treatment of tuberculosis (TB) involves taking anti-tuberculosis drugs for at least six months. Poor adherence to treatment means patients remain infectious for longer and are more likely to relapse or succumb to tuberculosis and could result in treatment failure as well as foster emergence of drug resistant tuberculosis.

Poor adherence leads to prolonged infectiousness, relapses, drug resistance and death Munro et al, (2007).

Due to the long courses of anti-TB medication and the associated side effects patient compliance with the medication is normally a struggle and this is a common occurrence among many other chronic diseases and the non-adherence rates reported are between 21-32% in countries like USA (Addington, 1979) and may be as high as 50% in some developing countries Kulkarni P et al, 2013). Closer in Uganda this has been found to be 25% among HIV/TB co infected patients.

This study sought to determine the salient patient factors related with compliance to anti-TB drugs among patients attending Njoro Sub County Hospital-Nakuru Kenya. It was found that TB patients attending the Njoro Sub County Hospital chest clinic frequently, tended to adhere to their medication. Patients’ also taking shorter time to be attended also adhered to their TB medication. TB patients with enough knowledge about the disease also complied with their medication. Non-alcoholic patients however conformed better than alcoholic patients with regards to TB medication.

2.2 Defaulting
Defaulting from tuberculosis (TB) treatment has been one of the major obstacles to treatment management and an important challenge for TB control. Understanding of various factors accounting for treatment default could help to achieve better compliance from patients.

The greatest danger to defaulters and those around them is the development of resistant forms of TB like MDR-TB and extensively drug resistant TB (XDR-TB) which are difficult to cure and cost a lot more Raviglione et al, (2001). The pressure is greater in the intensive phase of treatment where clinic duration are closer and longer duration of therapy Sagbaken et al., (2008) and more patients are found to default during this phase Kulkarni P. et al., (2013). The attitude of health workers to TB patients or patients’ perceptions of health provider may also influence patient compliance. Patients who feel they are unfairly or rudely treated may be discouraged from continuing with the treatment Sagbaken et al., (2008). Study done in Russia showed that substance abuse was a barrier to TB treatment and care which eventually led to non compliance, default and development of MDR TB Gelmanova et al., (2007:649). This study sought to investigate patient factors related with defaulting anti-TB drugs among patients attending Njoro Sub County Hospital-Nakuru Kenya. The investigations concluded that patients with poor relationship with health care providers were susceptible to default TB medication. Alcohol intake also contributed to defaulting. This study also indicates that patients on other drugs were highly susceptible to defaulting.

2.3 Statement of the Problem
The STOP TB campaign aims to have Zero MDR-TB, mortalities and high cure rate. For the last 2 years NJORO Sub County has experienced a slight number of multidrug resistant tuberculosis with only a patient reported in Njoro Sub County Hospital. High TB defaulting rates was also observed in NJORO Sub County Hospital which contributed to drug resistant tuberculosis among patients in the area. Distance to the treatment centers, alcoholism, unhealthy patient provider relationship, and appointment schedule are among factors thought to contribute to poor adherence in NJORO division. Poor adherence leads to prolonged infectiousness, relapses, drug
resistance and death Munro et al., 2007). Patients who fail to complete the standard course of treatment may develop MDR-TB and extensively drug resistant TB (XDR-TB). This situation jeopardizes the prevention and control strategy of TB and that may result to high treatment cost, development of relapses, mortalities and MDR-TB. This study sought to explore patient factors that contribute to adherence to anti-tuberculosis medication.

2.5 Justification
Poor adherence to anti-tuberculosis drugs has led to the emergence of resistant TB strains. Some of the forms are multi-drug resistance tuberculosis (MDR) and extensive drug resistant (XDR). These forms of tuberculosis are expensive to treat and therapies take long. The cost of treating resistant forms of TB is more expensive than the non-resistant forms. Approximately Ksh. 2 million is required to treat each patient with MDR-TB (Partnership, 2013). This put a lot of stress on an already strained health budget. Drugs used to treat resistant forms of TB have severe side effects (Torun T, 2005). In addition the success rates of treating resistant forms of TB are much lower (48% for MDR-TB) compared to the non-resistant TB forms (87%) (WHO, 2012). Therefore understanding factors considered important by patients which may contribute to TB medication adherence, will facilitate the reduction of TB resistant cases and lower the number of new infection. This study sought to contribute to policy makers’ ideas when formulating laws guiding TB treatment and also recommendations to implementers for enhancing TB prevention and control strategies and suggest further studies in more identified gaps. The study aimed to answer the following questions:

i. What patient factors are related with patient compliance to anti-TB medication in Njoro Sub County Hospital?

ii. What patient factors are related with patient defaulting anti-TB medication in Njoro Sub County Hospital?

2.6 Objectives

2.6.1 Broad Objective
The study aimed at determining patient factors influencing adherence to anti-TB medication among patients attending Njoro Sub County Hospital-Nakuru, Kenya.

2.6.2 Specific objectives
i. To determine patient factors associated with patient adherence to anti-TB drugs among patients attending Njoro Sub County Hospital-Nakuru Kenya.

ii. To determine patient factors associated with patient defaulting anti-TB drugs among patients attending Njoro Sub County Hospital-Nakuru Kenya.

2.6.3 Scope and Limitation of the Study
The study mainly focused on TB patients attending the chest clinic for the last two years at Njoro Sub County Hospital. A total number of 25 patients formed part of the study.

CHAPTER THREE: METHODOLOGY
3.0 Introduction
This chapter addressed the set of methods, rules and postulates employed in the study. It involves set procedures of inquiry on adherence and defaulting on anti-TB drugs among patients in Njoro Sub County Hospital. This includes Study Area, Study Design, Study Population among other postulates.

3.1 Study Area
The study area was at Njoro sub county health Centre which is located in Njoro division in Njoro District, Nakuru County. It is 18km south west of Nakuru and it is the District headquarters of Njoro Sub County. It is the town of Kenya Agricultural research Institute and Egerton University which is situated 5km south from town centre. Njoro sub county hospital serves a catchment population of 141352 persons drawn from 5 locations (Kenya National Bureau of Statistics, 2010). The average number of patients per annum is 20,853 (NJORO medical Records Office). The TB clinic offers outpatient services and the average number of patients per year is 100

3.1 Study design
The study design adopted a cross-sectional study design. The choice of this design was due to fact that the study was to be carried out at one time or over a short time Stommel M et al, (2004). The rationale behind this research design was that, the study attempts to identify factors which influence a patient’s decision to strictly stick to TB treatment. Cross-sectional design was settled on because it is relatively easy, economical, and also considering time limitation to carry out study.

3.2 Study population
The study population was 100 TB patients attending NJORO sub county hospital TB clinic. Target population was TB patients currently on TB medication, defaulters or those who have completed TB medication.

3.3 Sampling Frame
The sample frame included all patients who are in TB clinic register and receive anti-TB medication.

3.4 Sampling technique
Convenient sampling technique was used to select study participants. Convenience method of sampling was also used for data collection. The minimum sample size required was 25 patients (25% of TB patients for a whole year). The sampling technique applied for patients in this study is coherent to that of Cohen and Manion (2006) that states that selection of at least a quarter of the sampling units is sufficient for the study of social science in nature. 25% of the respondents (patients) were sampled.

3.5 Inclusion and exclusion criteria
Patients who were 18 years old and above attending Njoro chest clinic were interviewed. However, patients who were too weak, sick and on transit were excluded from the study. Informed consent was sought before recruitment and administration of the questionnaires. Participant’s privacy and confidentiality was assured since interview was conducted in private. All identifiers were removed from questionnaires and only study numbers were used.

3.6 Instruments
Data was collected using questionnaires and where the respondents could not understand the researcher explained to them.

3.7 Data Collection Procedure
Questionnaire was used to collect data from TB patients at Njoro Sub County chest clinic to determine the salient factors influencing their adherence to anti-TB medication. The questionnaire was a suitable method of data collection because it allowed the researcher to reach a large number of respondents within the shortest period of time possible. It also ensured confidentiality and thus gathered more candid and objective information.
3.7.1 Pilot Test
The questionnaire was pre-tested to ensure that the tool had the capacity to measure what is intended. The questionnaire’s internal validity was assessed and vague terms identified and modified to enhance respondents’ understanding. This was done at Wesley Mission Health Centre with the help of the facility nurse and a random TB patient.

3.7.2 Data Processing and Analysis
The questionnaires yielded quantitative and qualitative data (from open ended questions). The quantitative data was collected from the patients visiting Njoro chest clinic. Data processing and analysis was done with the assistance of MS-Excel 2007. Descriptive analysis was used to summarize data and the findings then presented using bar and line graphs and also pie charts.

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSIONS

4.0 Introduction
This chapter interprets and explains the findings with regards to the stated research questions and specific objectives. The purpose of the study was to investigate the patient factors influencing anti-TB drugs adherence/defaulting among TB patients attending Njoro Sub-County Hospital, Nakuru County. Among the factors considered was alcohol intake, relationship between health care giver and the patient, smoking, side effects among other factors. The section also covers all the methods of data analysis, results and discussions. The results in this chapter have been organized according to the research objectives, with the first section dealing with demographic characteristics of respondents.

4.1 Demographic characteristics of respondents
The demographic characteristics that were discussed are age, gender, level of education, pills missed, employment and marital status. These characteristics were important because they had a bearing on the TB patients' adherence/defaulting.

4.1.1 Age of respondents
When the study sought to establish the average age and mode of respondents, the results were as shown in figure 1.

![Figure 1 Descriptive statistics on the respondents’ age](image-url)
The average age of respondents was at 38.72 with a majority of female respondents having reached the age of 38 and above as compared to their male counterparts. The mode age was 35 with two of who are male and one being a female respondent.

4.1.2 Distribution of TB patients in Njoro Sub-County by sex by 25%
Regarding gender among the TB patients, the study got the responses indicated in figure 2.

![Gender Distribution Bar Chart](image)

**Figure 2**
Results showed that Majority of registered TB patients at Njoro sub-county chest clinic were female at 55% while their male counterparts were 45%. The study established that most female TB patients attended Njoro chest clinic as opposed to their male counterparts.

4.1.3 Distribution of TB patients in Njoro Sub-County chest clinic by Education level
Regarding the level of education among TB patients, the study obtained the responses indicated in Table 4.1.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Primary</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>Secondary</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>Tertiary</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

Results indicated that majority of patients with 40% had primary education as the highest qualification. 32% had secondary education with 5% having tertiary education. A paltry 8% had no education qualification. A study conducted on assessment of factors contributing to treatment adherence and knowledge of TB transmission among patients on TB treatment in Ndola, Zambia found out that most male TB patient respondents tended to be older and more educated than the female TB patients respondents.
4.1.4 Distribution of TB patients in Njoro Sub-County chest clinic by Marital Status

Marital status of respondents as shown in Table 4.2.

### Table 4.2

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Married</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Widowed</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Separated/Divorced</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The results showed that a number of participants were married at 60% followed by single at 20% while 12% were widowed. Only 8% of the participants had separated/divorced.

4.1.5 Distribution of TB patients in Njoro Sub-County by Employment status

Employment status as indicated in Table 4.3.

### Table 4.3

<table>
<thead>
<tr>
<th>Employment</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>9</td>
<td>36</td>
</tr>
<tr>
<td>Self</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>Salaried</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Casual</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The results indicated that a bigger portion of the participants were unemployed at 36%, with 28% being casual labourers, 26% were self-employed and only 12% were salaried.
4.1.6 Distribution of pills missed in the last five days

Distribution of visits which were missed by respondents, as shown in Table 4.4

Table 4.4

<table>
<thead>
<tr>
<th>Number of drugs missed</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>2.00</td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>3.00</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>4.00</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>5.00</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The findings indicated that out of the 8 participants who missed the anti-TB drugs, majority 50% had missed 2 pills in the last five days, 25% had missed only 1 pill while the rest had missed 3 or more times as shown on the table.

4.2 Patient factors associated with patient adherence to anti-TB drugs among patients attending Njoro Sub County Hospital-Nakuru Kenya

4.2.1 Chest Clinic Attendance and Adherence

Chest clinic attendance as indicated in Table 4.5

Table 4.5

<table>
<thead>
<tr>
<th>How often do you come for chest clinic</th>
<th>Once a week</th>
<th>Twice in a month</th>
<th>Once in a month</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever missed anti-TB drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>20%</td>
<td>40%</td>
<td>40%</td>
<td>100%</td>
</tr>
<tr>
<td>NO</td>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>50%</td>
<td>35%</td>
<td>15%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>44%</td>
<td>36%</td>
<td>20%</td>
<td>100%</td>
</tr>
</tbody>
</table>
The results show that majority of the patients who defaulted their drugs visited the chest clinic either once a month (40%) or twice a month (40%). Consequently, majority of patients who visited chest clinics weekly (50%) did not default their drugs. These visits to the chest clinic had a major impact on adherence.
4.2.2 Side Effects and Adherence
Side effects as indicated in Table 4.6.

Table 4.6

<table>
<thead>
<tr>
<th>Do you experience side effects after taking drugs</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ever missed anti-TB drugs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>Frequency</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>% within Ever missed anti-TB drugs</td>
<td>60.0%</td>
<td>40.0%</td>
</tr>
<tr>
<td>NO</td>
<td>Frequency</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>% within Ever missed anti-TB drugs</td>
<td>20%</td>
<td>80%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Frequency</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>% within Ever missed anti-TB drugs</td>
<td>28%</td>
<td>72%</td>
</tr>
</tbody>
</table>

The findings indicate that a number of patients (60%) who defaulted cited that they experienced side effects upon taking the drugs. This implies that a side effect is among the contributors to poor adherence. A bigger proportion (80%) of those who complied with the treatment indicated that they never experienced side effects after taking the drug. A study conducted by Graner, 2007 in Kyrgyzstan prisons in Zurich on factors promoting adherence to TB medication, found out that the regimen recommended for treatment of TB was associated with significant side-effects. Side effects such as hepatitis, dyspepsia, and arthralgia were responsible for termination of therapy in up to 23% of patients during the intensive phase of treatment. These side-effects were also found to be significantly associated with defaulting hence influencing drug adherence.

4.2.3 Information, Knowledge and Adherence
Information/knowledge on the disease as indicated in Table 4.7

Table 4.7

<table>
<thead>
<tr>
<th>Did health care give any information</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ever missed anti-TB drugs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>Frequency</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>% within Ever missed anti-TB drugs</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>NO</td>
<td>Frequency</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>% within Ever missed anti-TB drugs</td>
<td>90%</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>21</td>
<td>4</td>
<td>25</td>
</tr>
</tbody>
</table>

The findings show that a high proportion of patients adhering to anti-TB drugs (90%) indicated that health care providers assisted them with all the relevant information about the disease. Consequently, 40% of defaulters cited that they were not provided with information on the disease as opposed to 60% who had the information but defaulted. This showed that adherence was highly related to the information held by the patient on the disease.
4.2.4 Counseling on Drug Adherence
Counseling on drug as indicated in Table 4.8.

<table>
<thead>
<tr>
<th>Did health care counsel you on drugs</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ever missed anti-TB drugs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>80.0%</td>
<td>20.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>NO</td>
<td>19</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>95%</td>
<td>5%</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>23</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>92%</td>
<td>8%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The findings revealed that patient counseling determined adherence. This is because 95% of the patients counseled have never missed their anti-TB drugs while 20% of those who missed were not counseled at all. However, 80% of those counseled missed their drugs, and only 5% were not counseled but still adhered.

4.2.5 Alcohol and Adherence
Alcohol intake as indicated in Table 4.9.

<table>
<thead>
<tr>
<th>Do you take alcohol</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ever missed anti-TB drugs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>40.0%</td>
<td>60.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>NO</td>
<td>3</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>15.0%</td>
<td>85.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>TB drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% within</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever missed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>anti-TB drugs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>80%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The findings revealed that 80% of patients who adhered to the anti-TB drugs did not take alcohol. Further 40% of the patient who defaulted the drugs also took alcohol. This implies that challenges of adherence were higher among alcohol lovers as opposed to non-alcoholics.
4.2.6 Frequency of Alcohol and Adherence

Alcohol frequency as indicated in Table 4.10

Table 4.10

<table>
<thead>
<tr>
<th>How frequent do you take alcohol</th>
<th>Daily</th>
<th>Once a Week</th>
<th>Once a month</th>
<th>Occasionally</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever missed anti-TB drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>Frequency</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>100.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>NO</td>
<td>Frequency</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>33.3%</td>
<td>0.0%</td>
<td>66.7%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>Frequency</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>60.0%</td>
<td>0.0%</td>
<td>40.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The results show that all of the TB patients taking alcohol on daily basis (100%) missed their TB drugs only 33.3% of patients who took alcohol daily adhered to their TB medication.

4.2.7 Clinic Duration and Adherence

Duration to be attended to at Njoro Sub County Hospital as shown in Table 4.11

Table 4.11

<table>
<thead>
<tr>
<th>Duration to be attended</th>
<th>Less than 15 mins</th>
<th>15-30 mins</th>
<th>More than 30 minutes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever missed anti-TB drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>Frequency</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>0.0%</td>
<td>40.0%</td>
<td>60.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>NO</td>
<td>Frequency</td>
<td>2</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>10.0%</td>
<td>65%</td>
<td>20.0%</td>
<td>100%</td>
</tr>
</tbody>
</table>
The findings revealed that the majority 60% of patients who missed drugs took more than 30 minutes to be attended to. On the other hand, majority 65% of patients who did not default indicated that they were served between 15 and 30 minutes while 20% were served in more than 30 minutes. This implies that the duration taken for patients to be attended in the hospitals influenced a lot on their compliance/defaulting to anti-TB medication.

4.3 Patient factors associated with patient defaulting anti-TB drugs among patients attending Njoro Sub County Hospital-Nakuru Kenya

4.3.1 Relationship with Health Care Provider and Defaulting

The results indicate that about half of the patients 60% and 25% who adhered well to the TB drugs had a very good relationship respectively with health care providers at the Njoro Sub-County chest clinic. The number was however smaller for those who defaulted with only 20% having very good and a good relationship respectively. This hence indicates that relationship with health care provider played a very major role on adherence. Poor relationship promoted defaulting. Some scholars have found that compliance is good when health care providers are emotionally supportive, give reassurance or respect and treat patients as equal partners (Jin, et al., 2008). Furthermore, results of a study by Gebremariam, et al., 2010 showed that the majority of patients were happy about the way health professionals received and treated them at the health centers. Some participants said that they were encouraged to go for treatment because health professionals received them with a “good face” and encouraged them to finish their treatment.
4.3.2 Other Drugs and Defaulting

Other drugs as indicated in Table 4.13.

Table 4.13

<table>
<thead>
<tr>
<th>Are you on other Drugs</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ever missed anti-TB drugs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td>Frequency</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>60.0%</td>
<td>40.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td>Frequency</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>20%</td>
<td>80%</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Frequency</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>28%</td>
<td>72%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The study found that most of TB patients who adhered to their drugs (80%) were not on other drugs as opposed to 40% who missed their drugs. Consequently, 60% of those who missed their drugs were also on other drugs. This therefore, implies that other drugs averagely affected adherence to anti-TB drugs. Other types of drugs commonly administered to some TB patients include; Anti-retroviral (50%), Anti-diabetic drugs (13%), Anti-hypertensive (12%) and others at 25%. In respect to these findings a study conducted by (Gebremariam, et al., 2010) showed that patients attributed pill burden to be one of the major challenges of concomitant treatment: They used expressions such as “becoming a drug bag” and “becoming a pharmacy”.

4.3.3 Smoking and Defaulting

Smoking as shown in Table 4.14

Table 4.14

<table>
<thead>
<tr>
<th>Influence of Smoking and defaulting to anti-TB drugs</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Do you smoke</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EVER missed anti-TB drugs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td>Frequency</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>20.0%</td>
<td>80.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td>Frequency</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>10.0%</td>
<td>90.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Frequency</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>12%</td>
<td>88%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The results show that majority of anti-TB drug defaulters (80%) were not smokers, only 20% were. Consequently, 90% of drug compliant patients were not smokers and 10.0% smoked yet they never defaulted the drugs. Smoking therefore had a very minor influence on defaulters if any.
4.3.4 Medical Cost Incurred and Defaulting

Medical Cost Incurred as indicated in Table 4.15.

Table 4.15

<table>
<thead>
<tr>
<th>Any Medical Cost incurred</th>
<th>Yes</th>
<th>No</th>
<th>Not Sure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever missed anti-TB drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>20.0%</td>
<td>80.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>3</td>
<td>17</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>15%</td>
<td>85%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>4</td>
<td>21</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>16%</td>
<td>84%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The findings revealed that majority of patients 84% indicated that they never incurred any medical cost. Majority 80% of those who defaulted never incurred any medical costs similarly to 85% who complied. Cases of medical charges were scanty across those who were interviewed. Hence there is no clear indication on whether charges influenced defaulting.

4.3.5 Chest Clinic Interference with Work Schedule and Defaulting

Interference with work schedule as shown in Table 4.16.

Table 4.16

<table>
<thead>
<tr>
<th>Does chest clinic interfere with work schedule</th>
<th>Not at all</th>
<th>A little</th>
<th>A lot</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever missed anti-TB drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>% within Ever missed anti-TB drugs</td>
<td>20.0%</td>
<td>20%</td>
<td>60%</td>
<td>100.0%</td>
</tr>
<tr>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>% within Ever</td>
<td>54%</td>
<td>18.9%</td>
<td>27.2%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
The findings revealed that majority of those patients who defaulted the drugs 60% found the chest clinic to interfere a lot with their work schedules, 20% cited that it interfered but a little. Consequently, 18.9% of those who complied indicated that the chest clinic had little interference while 54% cited that this did not at all interfere with their work schedule. This hence shows that interference with work schedule influenced defaulting.

### 4.3.6 Side Effects and Defaulting

Side effects as shown in Table 4.17.

<table>
<thead>
<tr>
<th>Table 4.17</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peripheral Neuropathy</td>
<td>7</td>
</tr>
<tr>
<td>Nausea and Vomiting</td>
<td>10</td>
</tr>
<tr>
<td>Jaundice</td>
<td>3</td>
</tr>
<tr>
<td>Gastritis</td>
<td>2</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

The results indicate that nausea and vomiting was the most experienced side effect by patients at 40% followed by Peripheral Neuropathy (28%), Jaundice and Diarrhea tying at 12% and gastritis (8%). This majorly contributed to defaulting on anti-TB drugs.
4.3.7 Frequency of Alcohol and Defaulting

Frequency of alcohol intake as shown in Table 4.18.

**Table 4.18**

Frequency of Alcohol and adherence to anti-TB Drugs

<table>
<thead>
<tr>
<th>How frequent do you take alcohol</th>
<th>Daily</th>
<th>Once a Week</th>
<th>Once a Month</th>
<th>Occasionally</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ever missed anti-TB drugs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>Frequency</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% within Ever missed anti-TB drugs</td>
<td>100.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>NO</td>
<td>Frequency</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% within Ever missed anti-TB drugs</td>
<td>33.3%</td>
<td>0.0%</td>
<td>66.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Frequency</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% within Ever missed anti-TB drugs</td>
<td>60.0%</td>
<td>0.0%</td>
<td>40.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

The results indicate that all of the TB patients taking alcohol on daily basis (100%) missed their TB drugs. 33.3% of patients who took alcohol daily adhered to their TB medication. Hence the frequency of alcohol consumption among TB patients determined greatly their default to anti-TB drugs.

**CHAPTER FIVE: SUMMARY CONCLUSIONS AND RECOMMENDATION**

5.0 Introduction

This chapter discussed the findings of the study in summary, concludes and recommends measures for action by various stakeholders in public health and TB prevention and cure programmes. Default to TB treatment is a major barrier to optimal care of TB patients, and an important challenge in the national TB control program. Completion of treatment is the necessary condition for the patient’s cure and the prevention of multi-resistant TB strains.

5.1 Summary of the research findings

The aim of the study was to identify patient factors that influence compliance and default to anti-TB drugs respectively among patients attending Njoro chest clinic in Nakuru County. Questionnaire was used to take data from patients attending Njoro chest clinic while the interview guide helped to explain to patients on the nature and response expected from questions. Data obtained from the questionnaires was analyzed using excel and tables. Analysis was based on the respondents’ responses in relation to their adherence or compliance with the drug. The study established the following as the factors contributing to default in anti-TB drugs among patients.

The findings revealed that 50.0% of the patients had missed anti-TB drug within the last five days preceding the date of the interview. This implies that the level of drug default was relatively high. Majority of the patients who defaulted their drugs visited the chest clinic either once or twice a month. Meaning that regular visit to the clinic improved or enhanced perfect adherence may be through
regular remainders of how to take their drugs well. Consequently, the duration taken for patients to be attended at the hospital influenced a lot on their compliance to medication. Cases of medical charges were scanty across; however, there is no clear link on whether charges influenced default. Compliance was highly associated with the level of interference with their work schedules. Majority of patients who defaulted drugs attributed it to conflict with work schedules. Relationship with health care providers also played a very key role on adherence; good relationship improved adherence while bad relationship derailed compliance. Compliance was also highly related with the information held by the patient on the disease, similarly patient counseling also determined adherence. Majority of patients who missed drugs confirmed that indeed this was as a result of the side effects. Being on multiple drugs also influenced default on anti-TB drugs, these meant multiple side effects. Default challenges were higher among alcohol lovers as opposed to non-alcoholics. This was due to alcohol influence that may have resulted into forgetfulness or ignorance. Smoking however, did not significantly influence patients to comply or default the anti-TB drugs.

5.2 Conclusions
This study therefore concludes that default to anti TB drugs was still common among TB patients attending Njoro Sub County Hospital.

i. The main factors that enhance adherence include the level of information held by the patient on the disease, side effects, Alcohol, clinic duration, lack of counseling and frequency of attendance to chest clinic.

ii. Consequently, the main factors that contributed to defaulting anti TB drugs include alcohol influence, poor relationship with the health care provider, side effects, patients on other drugs and conflict between visiting hours and work schedule.

5.3 Recommendations
The study therefore recommends the following action by Njoro Sub County Hospital Stakeholders, the Ministry of Medical Services and the Division of Public Health:

i. More awareness campaigns should be done for patients to understand more about the disease, the medication process and the importance of regular visits to enhance compliance.

ii. The time should be adjusted accordingly to accommodate the busy schedules of employees who find it difficult to get to the health facility and health care providers should improve their relationship with TB patients to enhance adherence.

There is also an urgent need for Njoro Sub County Hospital with the help of Nakuru County Government and NACADA to device a programme that would help sensitize TB patients on the dire effects of alcohol abuse in turn this would help reduce the possibility of missing anti TB drugs and defaulting.

REFERENCES


APPENDICES

Appendix I - Informed Consent Form

TITLE: Health care system factors that influence adherence to anti-tuberculosis medication among patients in Njoro sub county health center

INVESTIGATOR: Spencer Oyugi

PROCEDURES

An interviewer administered questionnaire will be used to collect baseline data.

RISKS

There exists no potential risks

BENEFITS

No direct benefits will be realized by the participants. However the information collected will contribute to scientific knowledge on management of TB cases in our healthcare settings.

PRIVACY AND CONFIDENTIALITY

I understand that I am entitled to utmost privacy during all the steps that will be undertaken during this research study. Only authorized research staff will be privy to private information I divulged as a result of this study and such information can only be shared with another third party after my express written consent

RIGHT TO REFUSE PARTICIPATION/WITHDRAW

I understand that it is within my right to freely to withdraw from this study or any of its procedures at any time that I feel I cannot go on without a feeling of guilt or obligation to anyone.

PRIVACY AND CONFIDENTIALITY

I understand that I am entitled to utmost privacy during all the steps that will be undertaken during this research study. Only authorized research staff will be privy to private information I divulged as a result of this study and such information can only be shared with another third party after my express written consent

SIGNATURE OF PARTICIPANT…………. DATE …………………………

SIGNATURE OF STUDY STAFF ………. DATE ………………………..

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Appendix II-Questionnaire

Questionnaire Unique No.___________

Part A

1. Date of interview ___/___/___ (dd/mm/yy):
2. Age (in years) _______
5. If employed does clinic attendance interfere with your work schedule
7. How long does it take you to reach the health facility?
   Less than 30 mins(1)30min to 1 hour (2) between1-2 hours (3) more than 2hours (4)
8. How long does it take for you to be attended to
9. How often do you come to the chest clinic?
10. How much do you pay for transport per trip per visit? Ksh……………………………
11. Do you incur any cost of medication?
    Yes [1] No[2]
12. If yes how much per visit? Ksh…………………………
13. How is the relationship between you and your health care provider?
    Very good (1) Good (2) Somewhat good (3) Bad (4) Very Bad (5)
14. Did the health care provider give you any information concerning your illness?
    Yes (1) No (2)
15. If yes specify…………………………………………………………………………………………………………………………
    ……………………………………………………………………………………………………………………………………………
16. Did the health worker counsel you on drug adherence
    Yes [1] No [2]
17. Are drugs always available at the health facility on every visit? Yes(1) No(2)
18. How many pills do you take per day?.......................
19. Do you receive any injections?
    Yes [1] No [2]
20. Have you ever missed any injections or drugs?
    Yes [1] No [2]
21. How many injections or drugs have you missed taking in the last 5 days………………..
22. Do you experience any serious side effects after taking your drugs
23. Have you ever missed taking drugs because of any side effects
   Yes [1]  No [2]

24. If yes which ones………………………………

25. Are you on any other medication for any other chronic illness?
   Yes [1]  No [2]

26. If yes which one

27. Do you receive any food support
   Yes [1]  No [2]

28. Do you take alcohol
   Yes [1]  No [2]

29. How frequent

30. Do you smoke
   Yes [1]  No [2]

31. How frequent
### Appendix III- Implementation Schedule

<table>
<thead>
<tr>
<th>DATE</th>
<th>ACTIVITY</th>
</tr>
</thead>
<tbody>
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<td>3&lt;sup&gt;rd&lt;/sup&gt; January to 31&lt;sup&gt;st&lt;/sup&gt; January 2016</td>
<td>Proposal Development</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; February to 29&lt;sup&gt;th&lt;/sup&gt; February 2016</td>
<td>Data Collection</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; March to March 2016</td>
<td>Data Analysis</td>
</tr>
<tr>
<td>12&lt;sup&gt;th&lt;/sup&gt; April</td>
<td>Presentation</td>
</tr>
</tbody>
</table>
Appendix IV- Map
## Appendix V - Budget

<table>
<thead>
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<th>ITEMS</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationaries</td>
<td>1500</td>
</tr>
<tr>
<td>Internet</td>
<td>2000</td>
</tr>
<tr>
<td>Transport</td>
<td>1200</td>
</tr>
<tr>
<td>Photocopies</td>
<td>1000</td>
</tr>
<tr>
<td>miscellaneous</td>
<td>570</td>
</tr>
<tr>
<td>Totals</td>
<td>5570</td>
</tr>
</tbody>
</table>
CHANGES IN MORPHOLOGY AND YIELD OF TOMATO (*Lycopersicon solanum*) AT DIFFERENT TRANSPLANTING TIME

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Abstract- This study was carried out to examine the effect of different planting dates on growth, flowering and fruit yield of tomato during November 2013 to April 2014. Three transplanting were done at an interval of 10 days. The different transplanting dates were; December 10, December 20 and December 30. The experimental results showed that different planting dates showed significant influence on growth and reproductive characters of tomato including fruit yield. The first transplanting date, December 10 resulted in improvement of all the attributes including increased plant height (70.22 cm at 60 DAT), leaf number (62.3), branch number (9.07), cluster number (17.43), number of flowers plant⁻¹ (148.7), fruit number (86.38), number of fruit plant⁻¹ (86.08), fruit diameter (5.51 cm), fruit length (6.29 cm) and yield per hectare (66.46 t) compared to 2nd transplanting date, December 20 and 3rd transplanting date, December 30. Therefore, it is suggesting that earlier transplanting produced higher fruit yield of tomato.

Index Terms: Tomato, Transplanting time, Morphology and Yield

I. INTRODUCTION

Tomato (*Lycopersicon solanum*) is one of the most important popular fruit vegetable belong to Solanaceae family which is grown throughout the world including, Bangladesh. It is well known that it is the world’s largest vegetable crop after potato. Generally, tomato is grown in the winter season, November-April in Bangladesh. In terms of human health, tomato is a major component in the daily diet and constitutes of important sources including antioxidants- like lycopene, which acts as an anti-carcinogen and improves skin’s ability to protect against harmful ultra violet (UV) rays. It has been reported that lycopene relieves the oxidative stress in human, lowers the bad cholesterol level LDL. It is rich in vitamins and minerals and dietary fibre (Olaniyi et al., 2010).
The average yield being 9.96 ton ha\(^{-1}\) was reported by BBS, 2013. This fruit yield is lower in contrast with other tomato producing countries like China (49.87 ton ha\(^{-1}\)), India (20.11 ton ha\(^{-1}\)) and USA (87.96 ton ha\(^{-1}\)). The yield of tomato of Bangladesh is not enough in comparison to requirement. The low yield of tomato in Bangladesh is not the indication of low yield potentiality of this crop but the fact that this may be attributed due to different abiotic and biotic stresses including temperature, salinity, insects, pathogens, residual effect of pesticides, improper application of plant nutrients etc.

It is well known that climate change is a frightening issue on reduction of crop yield not only in Bangladesh but also all over the world. Presently, drought, changes of temperate, salinity, heavy metal contamination etc. affect the growth, development and yield of agricultural crops. In Bangladesh, usually early November is the planting time seems to be the best (Hossain et al., 1986) and late planting results in lower yield and enhanced disease infection in tomato. It was reported that fruit set was abundant only when night temperature was between 15°C and 20°C (Went, 1984). Curme (1992) also showed that fruit set varies with temperature as low (7.2°C) and with temperature as high (26.6°C). Tremendous decline in fruit set due to high as well as low temperature which disturb mechanisms involved in the development of male and female parts of the flowers (Lawhori et al., 1963). In some areas of our country particularly in the northwestern part, the night temperature falls even sometimes go below 5-6°C which results remarkable yield loss in tomato. These findings suggest that late time of sowing or transplanting-induces cold injury which exhibits a significant reduction on both growth and yield of tomato. Therefore, this experiment was conducted to examine the impact of different of transplanting time on morphology and yield of tomato.

II. METHOD AND MATERIALS

The experiment was conducted in the Agricultural Farm of Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh. The location of the experimental site is 23°74'N latitude and 90°35'E longitude at an altitude of 8.6 meter above the sea level under the agro-ecological zone of Modhupur Tract, AEZ-28 during December 2013 to April 2014 to examine the response to different planting time on morphology, yield and yield attributes of BARI Tomato-15. The experiment was laid out in single factors randomized complete block design with five replications. Treatments of the experiment was 10 December 2013 = First transplanting time (T\(_1\)), 20 December 2013 = Second transplanting time (T\(_2\)), 30 December 2013 = Third transplanting time (T\(_3\)). The total plot number was 3 x 5 = 15 The unit plot size was 1.8 m \times 1.5 m = 2.7 m\(^2\). The distance between blocks was 1m and distance between plots was 0.5 m and plant spacing was 50 cm \times 60 cm. The land was ploughed with tractor and power tiller for four times. Then the ploughed soil was brought into desirable fine tilth and leveled by laddering. The weeds and stubbles were cleaned properly. The final ploughing and land preparation were done
on 1 December, 2013. According to the lay out of the experiment the entire experimental area was divided into blocks and prepared the experimental plot for the transplanting of tomato seedling. In addition, irrigation and drainage channels were made around the plot. The following data were recorded during the experimental period morphological characters: plant height, number of leaves plant$^{-1}$, and number of branches plant$^{-1}$; yield contributing characters: number of flower clusters plant$^{-1}$, number of flowers plant$^{-1}$, number of fruits plant$^{-1}$, fruit length, fruit diameter, yield (kg plot$^{-1}$) and (t ha$^{-1}$). All the agronomic practices were done as per requirement. No serious diseases were observed during this experiment, but bird attack was a potential problem so that the guard was assigned at the research site

III. RESULT AND DISCUSSION

**Plant height (cm):**

In this study, the effect of transplanting time of tomato in relation to decline of temperature reduced the plant height. The plant height varied significantly due to the effect of decrease of temperature; observed at 20, 40 and 60 DAT (Figure 1). At 20 days after transplanting (DAT), the highest plant height (22.01 cm) was recorded from the T$_1$ (10 December, 2013) and the lowest (17.78 cm) was recorded from T$_3$ (30 December, 2013). At 40 DAT, the highest plant height (37.70 cm) was recorded from the T$_1$ (10 December, 2013) and the lowest (29.52 cm) was recorded from T$_3$ (30 December, 2013). At 60 DAT, the highest plant height (70.22 cm) was recorded from the T$_1$ (10 December, 2013) and the lowest value (62.66 cm) was recorded from T$_3$ (30 December, 2013). These data showed that plant heights are gradually increasing at all transplanting time whereas early transplanting shows maximum plant height than late transplanting. Here it is noted that, the seedlings height was gradually short to late showing (data not shown). Both the plants height and seedlings height were decreased due to decline the environmental temperature. Previous results showed that late transplanting induced cold condition reduced the length of plant height (Chen et al., 1999). These results are consistent with the finding of Lwahori et al. (1963) who stated that plant height decreased with decreasing trend of temperature. Recently, Srivastava et al. (2007) and More et al. (2014) reported that transplanting time has great effect on the regulation of plant architecture as well as plant height of tomato. Altogether, the present results suggest that plant height of tomato decreased with the late planting from optimum time of transplanting.
Figure 1. Effect of transplanting time on plant height of tomato at different days after transplanting, LSD\(_{0.05}\) = 0.6472, 1.816 and 1.714 for 20 DAT, 40 DAT and 60 DAT, respectively.

**Number of leaves plant\(^{-1}\)**

It is known to all that leaf is the main photosynthetic organ of plant along with the leaf number is a fundamental morphological character for plant growth and development. The number of leaves was counted to investigate the effect of different transplanting time on changes in the leaf number plant\(^{-1}\) of tomato at 20 DAT, 40 DAT and 60 DAT. Different days of transplanting showed a significant influence on the formation of leaves per tomato plant (Figure 2). In this experiment, the number of leaves in each plant was decreased due to increasing level of low temperature stress. At 20 DAT, maximum number of leaves plant\(^{-1}\) (8.31) was found from T\(_1\) and the lowest value (5.79) from T\(_3\) transplanting time. At 40 DAT, the highest number of leaves (21.46) was recorded from T\(_1\) and the lowest value (15.20) was found from T\(_3\). At 60 DAT, the highest number of leaves (62.39) was recorded from T\(_1\) whereas the lowest value (34.35) was recorded from T\(_3\). These results indicated that highest number of leaves plant\(^{-1}\) found from early transplanting time whereas minimum number of leaves was produced to late transplanting time which created cold injury to plants. Hossain *et al.* (1986) reported that total number of leaves plant\(^{-1}\) was enhanced by early showing. Therefore, altogether the experimental results indicate that late planting-induced cold environmental conditions decreased the number of leaves plant\(^{-1}\) of tomato.
Figure 2. Effect of transplanting time on the number of leaves plant$^{-1}$ of tomato at different days after transplanting, LSD$_{0.05}$ = 0.3610, 0.752 and 2.859 for 20 DAT, 40 DAT and 60 DAT, respectively.

Number of branches plant$^{-1}$

Tomato branches number plant$^{-1}$ was significantly influenced by transplanting times (Table. 1). The highest number of branch plant$^{-1}$ (9.07) was observed from the T$_1$ and the lowest value (5.27) was observed from T$_3$. Among dates of planting, early planting recorded the highest vegetative growth in tomato which was reported by Sing et.al. (2005). Mira et al. (2011) observed that number of branches plant$^{-1}$ was found to be gradually decreased with the late transplanting dates in same plant. Hence, the obtained results are consistent with many other previous published findings.

Number of flower clusters plant$^{-1}$

In this experiment, there was a significant difference in number of flower clusters plant$^{-1}$ at different transplanting time (Table. 1). The highest number of flower clusters plant$^{-1}$ (17.43) of tomato was found from T$_1$ and the lowest number of cluster (10.17) was recorded from T$_2$. Early planting induced early and more flower clusters initiation plant$^{-1}$ of tomato than late transplanting-induced cold injury. These results indicate that lower temperature reduces the formation of number of flower clusters plant$^{-1}$ as other above mentioned morphological characters. Therefore, it is suggesting that low temperature stress significantly affect the both vegetative and reproductive development in tomato.
Number of flowers plant$^{-1}$

Planting time had significant effect on number of flowers plant$^{-1}$ of tomato (Table. 1). The highest number of flower plant$^{-1}$ was observed from the T$_1$ (148.7) and the lowest (133.0) was observed from T$_3$ treatment. T$_1$ was statistically similar with T$_2$ (142.9). Hossain et al. (1986) reported that early sowing enhanced total number of flowers plant$^{-1}$. From these results, it was found that more flowers were produced from the early transplanted tomato seedlings than lately transplanted seedlings.

Number of fruits plant$^{-1}$

Number of fruits plant$^{-1}$ of tomato showed significant differences in response to transplanting time (Table. 1). The highest fruits number plant$^{-1}$ (86.38) was observed from the T$_1$ which was statistically similar to T$_2$ (82.11) and the lowest (73.33) was observed from T$_3$. Maximum number of fruit plant$^{-1}$ was recorded from early transplanting and the minimum from late, due to low temperature (BARI, 1989). Adelana (1976) and Drost and Price (1991) had also reported that late transplanting reduced fruit number and early showed increasing trend. Jong et al. (2009) had reported that the initiation of tomato fruit growth, fruit set, is very sensitive to environmental conditions. So, it can easily understand that environmental condition regulates the number fruits plant$^{-1}$ as when near optimum temperature was present produced highest number of fruit and in unfavorable temperature condition decreased the number of fruit plant$^{-1}$.

Fruit diameter (cm)

In this study, fruit diameter (cm) of tomato showed significant variation in response to transplanting time (Table. 1). The highest fruit diameter (5.51) was recorded from the T$_1$ which is statistically similar with T$_2$ (5.41) and the lowest (5.29) was observed from T$_3$ treatment. Madhumathi and Sadarunnisa (2013) reported that date of transplanting affected the fruit diameter of tomato. From the study of results it was found that early transplanting provided higher fruit diameter than the late transplanted tomato one and it was also reported by Javaheri et.al. (2014).

Fruit length (cm)

As consistent to fruit diameter planting time had significant influence on fruit length (cm) of tomato (Table. 1). The highest fruit length (6.29) was observed from the T$_1$ and the lowest (5.91) was observed from T$_3$. These data resulted that early transplanting time increased fruit length (cm) in contrast to late transplanting. Madhumathi and Sadarunnisa (2013) had reported that early transplanting showed the maximum fruit length of tomato fruit among different varieties.
Table: 1. Data on Number of branch, Cluster Number, Flower number, Fruit Number, Fruit Diameter and Fruit length of tomato as influenced by different Transplanting time

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of Branch</th>
<th>Cluster No.</th>
<th>Flower No.</th>
<th>Fruit No.</th>
<th>Fruit Diameter (cm)</th>
<th>Fruit Length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>9.07 a</td>
<td>17.47 a</td>
<td>148.7 a</td>
<td>86.38 a</td>
<td>5.514 a</td>
<td>6.291 a</td>
</tr>
<tr>
<td>T2</td>
<td>7.72 b</td>
<td>14.05 b</td>
<td>142.9 a</td>
<td>82.11 a</td>
<td>5.411 ab</td>
<td>6.137 b</td>
</tr>
<tr>
<td>T3</td>
<td>5.27 c</td>
<td>10.17 c</td>
<td>133.0 b</td>
<td>73.33 b</td>
<td>5.298 b</td>
<td>5.917 c</td>
</tr>
<tr>
<td>LSD(0.05)</td>
<td>0.575</td>
<td>1.477</td>
<td>6.248</td>
<td>5.886</td>
<td>0.175</td>
<td>0.0791</td>
</tr>
<tr>
<td>CV (%)</td>
<td>11.71%</td>
<td>15.91%</td>
<td>6.60%</td>
<td>10.92%</td>
<td>4.86%</td>
<td>1.94%</td>
</tr>
</tbody>
</table>

Yield in (kg plot\(^{-1}\)) and (t ha\(^{-1}\))

As morphological characters the yield of tomato also significantly reduced by late transplanting-induced cold stress (Fig. 3. A and 3. B). The highest yield (17.94 kg plot\(^{-1}\)) and yield (66.46 t ha\(^{-1}\)) were observed from the T1 and the lowest yield (12.32 kg plot\(^{-1}\)) and yield (45.62 t ha\(^{-1}\)) were observed from T3 or late planting. The results of both yield (kg plot\(^{-1}\)) and yield (t ha\(^{-1}\)) of tomato is gradually decreasing with the late transplanting, T3. These results are in consistent with the yield contributing characters which are analyzed in this experiment such as number of branch, number of flower cluster, number of flowers plant\(^{-1}\), fruit diameter and fruit length (Table. 1). These information are also dependable on growth measuring parameters of this study (Figure: 1, 2 and Table. 1). In addition, Sanjoy (1999) showed a declining trend in fruit yield and other yield attributing characters when planted lately. Tongova and Zhelev (1975) reported that early sowing or early planting of tomato give increased yield. Previous authors as well reported that early transplanting of tomato give increased fruit weight and yield of tomato (Adelana 1976). These results suggest that suitable transplanting time is more favorable to produce highest plant height, leaf number, branch number as a result higher flower produced which enhance the higher fruit set and development i.e. fruit diameter and length of tomato which contribute to maximum yield than late transplanting-induced cold injury. All together, these results suggest that suitable transplanting time is more favorable to produce highest plant height, leaf number, branch number as a result higher flower cluster, flower produced which enhance the higher fruit set and development i.e. fruit diameter and length of tomato which contribute to maximum yield than late transplanting-induced cold injury.
First transplanting time, 10 December 2013
Second transplanting time, 20 December 2013
Third transplanting time, 30 December 2013

Figure 3. Effect of transplanting time on the yield in kg plot\(^{-1}\) (A) and yield in t ha\(^{-1}\) (B) of tomato,

LSD\(_{0.05}\) = \(1.326\) and \(4.911\) respectively.

REFERENCES

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(Halal KING CAKES)

Making events and ceremonies more memorable with healthy cakes

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Abstract: Products of the bakery became a regular food in most part of the world and are important commodities today. Businessmen could sell potential products of bakery products and they are able earn potential benefits from the products. In business, Small-Medium Enterprises are mostly engaged in the bakery business but they cannot compete with the branded bakery Industry. In Malaysia the Small-Medium Enterprises (SME) are face difficulties to attain growth in the business of bakery products. People deal with the present issues which are faced by Small-Medium Enterprises and providing some valid recommendations to solve the existing problems in the bakery business. The case was analyzed and the findings are revealed that the Small-Medium Enterprises have not structured marketing strategies and need some enhancements in the areas of packaging.

To overcome customers’ satisfaction to buy the products the business model canvas (BMC is a business tool used to visualize all the building blocks of starting a business, including customers, route to market, value proposition and finance) and Value Proposition Design (VPD explains customers’ satisfactions, customers’ gains, and customers’ pains) will help to understand what is going on the bakery. A survey was conducted to understand customers’ needs, pains, and gains. The value should be added to the bakery products, focusing on the promotion and appropriate advertising strategies. Furthermore, the analysis is revealed that more coverage of selling points for bakery products. The increased number of distribution centers and proper motivations to the agents may definitely improve the marketing of bakery products.

I. INTRODUCTION

The Prophet Muhammad (pbuh) once reported to have said, “There are two kinds of knowledge: knowledge of religion and knowledge of the body.” The Prophet (pbuh) frequently commented upon the nature and value of various foods and spices. Therefore, the aim of King Cake is to bake healthy cakes for the Muslim world. According to a 2010 study that was released in January 2011, Islam has 1.6 billion adherents, making up over 23% of the world population. World's Muslim population more widespread than you might think. Retrieved from http://www.pewresearch.org/fact-tank/2017/01/31/worlds-muslim-population-more-widespread-than-you-might-think/. If you do not provide healthy cakes for the Muslim world, they be became overweight and might causing other diseases. However, some scholars say that celebrating birthday is haram. [Here][1]’s the fatwa in Arabic. But some trusted scholars who disagree and says its halal and you can celebrate birthday unless it involves haram acts, like drinking beer and so forth. It is indicated that Islam supports the celebration of birthdays if it is an expression of gratitude to Allah for His bounties, sustenance and blessings in man’s life. King cakes will provide halal cakes for any kinds of ceremonies such as celebrating Eid_ul_fiter, Eid_ul_Adhha and date of birth.

Moreover, King Cakes serve for people who are celebrating their ceremonies and birthdays. The aim of the product is to serve the Muslim Ummah. This business is based on the needs of the people in the society because Muslim people are not mixing alcohol inside the cakes. As King Cakes is aware nowadays people want everything in their door steps and do not want to waste their time to go far away from their houses to buy products. This small business will be helpful for them to buy and order cakes online. Therefore, in the near future Halal King Cakes will extend to all over the world because the aim is to serve Muslims in the world. In short, there is a lot of companies that are providing cakes but Halal King Cakes will be providing clean cakes and healthy cakes.

II. BACKGROUND

The potential part of the business is to have the expert and knowledgeable people in the company because they should understand how to create services for their customers and how to have great products in the society. You should know how to sell your products on the market? This is all important for us to understand and apply it for the business. As mentioned before for new start up business is important to know the environment of market and competitors. In addition, the knowledgeable financial admin is also essential for us to have because he should estimate the budget and expenses. For instance, a startup business what is important to buy? How to spend money for equipment? Why should buy the equipment? How to deliver the product in time?

III. PROBLEM STATEMENT
Some people are not able to celebrate their events, ceremonies and so forth. The bakery aim is to sell cakes for unfortunate and Masjid with less expensive and high quality than markets because the aim of bakery is to serve the society. In addition, people will celebrate their ceremonies and events more meaningful, joyful, and so on with affordable price, Halal, and high quality.

IV. METHODOLOGY

Selangor was taken for the purpose of survey because this area has a prominent place in the field of manufacturing and marketing of bakery products and here bakery industry is grown dramatically. For the purpose of survey less than 50 types of cakes were selected by the people. The research conducted a survey it was taken only three weeks because of collection data and Information. Both the primary and secondary data were used in this research study. For primary data two detailed questionnaires were prepared and pre-tested. The first questionnaire was to interview the people face-to-face and the second is distributed online. After that required corrections were made in them where seemed necessary. Secondary data were collected from the records of the selected customers from the society. From the interviews and distributed questioners we found that 86% of the people eager to buy our products. As a short, in the end findings of the research study were given with appropriate suggestions so as to reduce the production and marketing costs of bakery products in the area of the study.

V. LITERATURE REVIEW

1. Market leaders
   1.1 Amazon

   Amazon is a Fortune 500 e-commerce company based in Seattle, Wash. It has the distinction of being one of the first large companies to sell goods over the Internet. In 1994, Jeff Bezos founded Amazon, which launched the following year. If you're of a particular age, you likely remember that Amazon started out as an online bookstore and then quickly diversified by adding other items, including DVDs, music, video games, electronics, and clothing. But amazon also sell different types of cakes such as Bubur Ca Ca, Kuik Dadar, Onde-Onde, Wajik, Durian cake, Palm sugar rice cakes, Tapioca and coconut layered cake, Sweet mung bean fritters And many more. In 1999, just five years after he started Amazon, Jeff Bezos was named Time magazine's "Person of the Year." He received this honor largely because of the company's success in popularizing online shopping.

![Image of Amazon interface](https://example.com/amazon-interface.png)

*Figure 1: The Interface of Amazon.com*
According to business model canvas of Amazon (Figure 2), Authors and Publishers are the biggest partner of Amazon followed by Network of sellers. For the customer segment, Brands and retailers can leverage their loyalty programs and loyal customer base by providing exclusive products that will not be found on Amazon. Amazon generates revenue from sales of assets. Furthermore, Amazon emphasizes on doing business anywhere by connecting to the internet. The first time Amazon was selling only books but now Amazon is selling anything that can be found in the world including different types of cakes such birthday cakes and so forth.

1.2 SweetCartel.com

The company is a group of memory creators which help you to save the best memories in one's life. If a picture speaks a thousand words, our gift to you in the form of a cake in a cup captures a million pictures of your fondest event in life.
1.3 Mcdonalds.co.uk

One of the cornerstones of McDonald's success in the UK is its property portfolio, which provides a well located and convenient network of restaurants throughout the country for our customers to use and enjoy. There are over 1200 restaurants to be found in a variety of locations such as traditional high streets; shopping centers; retail parks; roadside locations; leisure centers; railway and airport termini and motorway service areas. McDonald’s are renowned for being the pioneers of the Drive Thru restaurant concept and are the UK and world leader in this sector. This continues to be the key focus for our growth.
It can be concluded that, Amazon is a business model in the 1990s for Internet entrepreneurs using the Web as a place for transactions. As consumers learned to replace physical distance with mouse clicks, Amazon created e-business and e-commerce models that generated massive profits for the online clearinghouse Ads by Google.

On the other hand, McDonald's is the world's leading global food service retailer with over 36,000 locations in over 100 countries. More than 80% of McDonald's restaurants worldwide are owned and operated by independent local business men and women. The last one is Sweet Cartel that is provides cupcakes and cups for their customers.

1. Summary of market leader
   1.1 Business Model Canvas framework

Table 1: Comparison of 9 blocks between Alibaba, Sephora, and Halal Shop.

<table>
<thead>
<tr>
<th>9 blocks</th>
<th>Amazon.com(Cakes)</th>
<th>SweetCartel.com</th>
<th>mcdonalds.co.uk (Cakes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Value Proposition</td>
<td>Convenience • Price • Instant Fulfillment with eReader • Vast selection</td>
<td>A number cups and cakes for customers to choose • Customization of the product (long run)</td>
<td>Providing well portioned, fun fast food for kids • Providing nutritional meal options for parents in a hurry</td>
</tr>
<tr>
<td>2. Customer Segment</td>
<td>Individual Leverage • Group Leverage • Global consumer market</td>
<td>People who wants to give returning gifts to their guest</td>
<td>Busy parents; may be in a rush • Children • Young people • Daycares • Schools</td>
</tr>
<tr>
<td>3. Distribution Channels</td>
<td>Affiliates • Application interface</td>
<td>Direct selling online(Pre order) • Events planner</td>
<td>Restaurant Chains • Airports • Malls</td>
</tr>
<tr>
<td>4. Customer Relationship</td>
<td>Self Service • Automated Service</td>
<td>Prepare hotline and email for enquires</td>
<td>New toys • Website • Ronald McDonald's House</td>
</tr>
</tbody>
</table>
5. Key Partners
- Logistics Partner
- Affiliates
- Authors & Publishers
- Xin Tian Di Bakery
- GoGoVan.com
- Cup supplier
- Toy manufacturer
- Rights to movie/TV characters

6. Key Activities
- Merchandising
- Production &
- Production
- Branding
- Cooking
- Deliver food

7. Key Resources
- Physical warehouses
- Human: Web application & development
- Cups
- Cakes
- Packaging
- Physical warehouses
- Raw Materials (meat, bun, toppings, frizzes, nuggets, boxes etc.)
- Toys
- Labor
- McDonald’s Brand

8. Cost Structure
- IT & fulfillment infrastructure
- Design cups
- Cups
- Cupcakes
- Advertising/Marketing
- Labor
- Materials

9. Revenue Stream
- Sell of assets
- E-book & content
- Acquisitions and investment
- Commission on
- Volume sales
- Unite sales
- Sale of food and toys
- Investment
- Franchises
- Kids parties

1.2 Below are key features identified from the three companies

1.2.1 Amazon.com
- Convenience checkout process
- Ease of shopping
- Various types of products including birthday cakes, ceremonies cakes
- Self service
- Customer support
- Secure payment
- Huge market

1.2.2 SweetCartel
- Ease of shopping
- Convenience checkout process
- Good quality of products
- Birthday cakes and cupcakes
- Secure payment

1.2.3 Mcdonalds.co.uk
- Has branches throughout the world
- Convenience checkout process
- Good quality of products
- Ease of shopping
- Ordering online

3 Environment Map

3.1 Key trend
In this century most of the people accessing to technologies and technology is creating an environment where data and voice networks can be combined to simplify business communication. And a business can save money and increase on its rate of production. If a business plans and manages its communication technology well, it can gain competitive advantage in
the market which will result into business growth. For instance, a business owner can use video conferencing technology to hold a meeting with their employees. This will save them time and reduce cost as they do more other beneficial roles which can result into business growth. Technology store big data on the cloud that is also reduces cost and saves money.

3.2 Market forces

The company will start serving globally throughout the world and will serve Muslim communities with high quality food with affordable price. And the company will get the feedback of customers because the aim is to serve the communities and the world. Any feedbacks will be accepted to improve the qualities of healthy cakes.

3.3 Industry forces

The company will provide different types cakes with different design because the company is worldwide. For instance, in Malaysia, most people like sweet cakes but in Afghanistan some people like salty cakes. It is indicated that whenever the company start business it should be understand the culture of the countries. The company might understand what types of cakes should be baked for their customers and to give value to the customers. Besides, the aging people and woman give more attention to their own health and they prefer more organic food. In order to aim a bigger market, Halal King Cakes has to produce more organic and healthy products due to the healthy diet flow.

3.4 Macroeconomic forces

Besides that there are lots of companies that bake cakes but they do not have the network of Masque such as Amazon and so forth. Halal King Cakes is ready to serve the Muslim communities with Halal Cakes when you hear Halal it means it is healthy as well. Halal King Cakes will include socioeconomic such as Unemployment levels, health care and other cost.

4 Four lenses of innovation

4.1 Challenging Orthodoxies: Challenge your beliefs and underscores the —why why why‖ on challenging the status quo.
   - Can I have more customers?
   - How to become top website?
   - How to make people trust on my product?

4.2 Harnessing Discontinuities: Understand the present heading in Trends in patterns of change.
   - Big data analysis.

4.3 Leveraging Competencies & Strategic Assets: Leverage Resources in every which way possible, including Open Innovation.
   - Using Bootstrap strategies

4.4 Understanding Unarticulated Needs: Understanding Needs of true customer and know customer perspective needs.
   - Feedback
   - Observation
   - Survey

V. CONCEPTUAL SOLUTION

1. Initial Business Model Canvas

The Business Model Canvass (BMC) was initially proposed by Alexander Osterwalder. It is a strategic management and lean startup template for developing new business models. It is a visual chart with elements describing a product’s value proposition, key partner, key activities, key resources, customer relationship, customer segment, cost structure, and revenue streams. Figure 8, shows the BMC of Halal King Cakes.
Figure 8: Business Model Canvas for Halal King Cakes

The company will make all of the celebrations more memorable and more wonderful. The aim is to provide more test cakes, delicious, luscious and so forth.

VI. EMPIRICAL FINDING

A. Customer’s buys in (Malaysia).

Customer’s buys are about what customers are going to buy. According to survey that was conducted, customers are willing to buy King Cakes. Most customers are willing to order cakes for ceremonies, such as, birthday, wedding and etc. Ordinal scales which are (Everyday), (Every week), (Every month), (Every 6 month), (Yearly), (I don’t ever buy this). The recapitulation customer’s buy shown in table 1.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Customers</th>
<th>Q No</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you tend to buy Tarts and Pastries?</td>
<td>1 everyday</td>
<td>2%</td>
<td>25%</td>
</tr>
<tr>
<td>How often do you tend to buy Indulgent Desserts such as</td>
<td>2 everyday</td>
<td>6.30%</td>
<td>12.50%</td>
</tr>
<tr>
<td>How often do you tend to buy Sponge Cakes such as Lemon Drizzle and</td>
<td>3 everyday</td>
<td>10%</td>
<td>12%</td>
</tr>
<tr>
<td>How often do you tend to buy Special Diets cupcakes?</td>
<td>4 everyday</td>
<td>6%</td>
<td>20%</td>
</tr>
<tr>
<td>How often do you tend to buy Cakes for Occasions and Birthday Cakes?</td>
<td>5 everyday</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>How often do you tend to buy Cakes/Desserts for Dinner Parties and are there any other cakes/desserts missing from this list that you</td>
<td>6 everyday</td>
<td>7%</td>
<td>13%</td>
</tr>
<tr>
<td>Are there any other cakes/desserts missing from this list that you</td>
<td>7 everyday</td>
<td>5%</td>
<td>25%</td>
</tr>
</tbody>
</table>

B. Customer’s Pain in buying cakes:

Pain in buying Cakes from Bakery this is the problem that customers facing with celebrating their ceremonies.
According to the survey most IIUM students and staff are not satisfied with the bakery in IIUM.

**TABLE 2: Specific pain of students in buying cakes**

<table>
<thead>
<tr>
<th>Statements</th>
<th>Customers</th>
<th>Q</th>
<th>A supermarket</th>
<th>Every Week</th>
<th>A café</th>
<th>A Bakery</th>
<th>Other</th>
<th>I don’t ever buy this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where do you buy each of the above types of cakes/desserts from? Please select AS MANY places per type of cake/dessert?</td>
<td>1</td>
<td>25%</td>
<td>15%</td>
<td>18.80%</td>
<td>6%</td>
<td>25%</td>
<td>12%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**C. Customer’s gains from Bakery:**

Most of the students and staff are gaining from the bakery because of buying cakes for their families, friends and so forth. According to survey most of IIUM students and staff are satisfied with King Cake’s products.

**TABLE 3: Specific gains of customers from products**

<table>
<thead>
<tr>
<th>Statements</th>
<th>Customers</th>
<th>Q</th>
<th>Selfserve</th>
<th>Workplace</th>
<th>Family &amp; friends</th>
<th>Birthday</th>
<th>Occasion</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which of the following occasions, if any, do you buy cakes/desserts for? Please select AS MANY as possible</td>
<td>1</td>
<td>22%</td>
<td>16%</td>
<td>20.00%</td>
<td>8%</td>
<td>26%</td>
<td>8%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**VII. ENHANCEMENT OF BUSINESS MODEL**

1. **Business Model Canvas (BMC)**

   **Key Partners**
   - Bakers
   - Mosque
   - Bakery
   - Services

   **Key Activities**
   - Delivery
   - Serving in the Shop
   - Promotion advertising
   - Marketing
   - Social media
   - Cake storage

   **Key Resources**
   - Baker
   - Cakes
   - Packaging

   **Value Proposition**
   - Delicious and cheap cakes
   - Trusted
   - Quality
   - Fast delivery

   **Customer Relationships**
   - Prepare hotline and email for enquiries
   - Social media

   **Channels**
   - Network of Mosque
   - Selling Online
   - Mobile apps for Android & iOS

   **Cost Structure**
   - Cake supplies cost
   - Marketing cost
   - Labor cost
   - Motorcycles cost
   - Place cost
   - Decorations cost
   - Tools cost
   - Uniforms cost
   - Monthly Allowance

   **Revenue Streams**
   - Cake selling
   - Donation

   **Figure 9: Enhancement of Business Model Canvas: Halal King Cakes**

   **A. Customer Segment**
   As in Figure 5, Customer segments of King is to serve Halal Cakes for Muslim and those who eager to purchase cakes form Halal King cakes company.

   **B. Value proposition**
   The products that King cakes will produce are with high quality and low price. In this case, it is produced for those who are looking for low price and high quality. The customers will choose us because of using high quality of ingredients for our Cakes. However, King Cakes has free delivers and discount for those who are buying more than three cakes ceremonies.

   **C. Channels**
   Halal King Cakes channel to help the customers to communicate via websites and mobile application and the customer can download the free from app store or Apple store. Moreover, this platform also uses the concept of Network of Mosque which allows all people to visit this website without specific genders or ages.

   **D. Customer relationship**
   Customer relationship block explains the type of relationships between the company and customers segments by www.ijsrp.org
helping poor people to celebrate their ceremonies and other events. And the customers will notify when the company has new promotions and products.

**E. Key resources**

Key resources are the most important assets required to make a business model work. The key resources are the company’s employees and its shop on a-locations.

**F. Key activities**

Key activities are the most important actions a company must take to operate successfully. For Online Halal King Cakes, the key activities include develop platform, verify halal product and the website updated frequently.

**G. Key partners**

The key activities King Cake’s engages in is the marketing and selling Birthday Cakes and events

**H. Cost structure**

The cost structure consists of employee loans, shop, raw materials procurement and marketing costs.

**I. Revenue streams**

King Cakes revenues are generated at the shop owned by the company itself and those owned by its franchise holders.

2. Value Proposition Canvas (VPC)

The value proposition is one of the strategic management to understand the customers’ needs and design the products and service according to customers’ satisfaction. There are two values proposition canvases, which are for seller and buyer. These two customer segments have different need of using the application. Therefore, values proposition canvas can help the researcher figure out what are the customers’ need and meet their satisfaction.

The VPD that is shown in Figure 10 is for seller. Halal King Cakes will be helpful to sellers to sell their products in the platform of Halal King Cakes in order to get more benefits. Moreover, the seller can increase their customer base worldwide because halal king cakes will be providing different types of cakes with different sizes.

![Value Proposition Canvas](image)

*Figure 10: Value Proposition for Seller*

Besides, many customers have difficulty to find trusted halal products due to many occurrences of fake halal products.
Halal King Cakes application will help them to ensure that they will be got Halal products form King Cakes Company. Other gain of buyer is easy e-payment and fast delivery. This platform will provide them not only easy e-payment but also secure and confidential payment. Thus, customers can purchase trusted Halal King Cakes products with different sizes for events and ceremonies.

**Figure 11: Value Proposition for Buyer**

3. Environment Map

Business models are designed and operated in a specific environment. The vast majority of packaging is paper and cardboard. Whilst Halal King Cakes do use plastic where necessary, it tried to keep this to the minimum, and certainly it is used far less on products than the average equivalent product from a supermarket. Halal King Cakes are now using jute carrier bags and plastic carrier bags are made from biodegradable plastic.

**Figure 12: Business model environment map**
4. Strategy canvas

The comparison in term of key features of four vendors, which are Amazon, McDonalds, SweetCartel and Halal King Cakes are shown in Figure 13.

![Strategy canvas](image)

**Figure 13: Strategy canvas**

VIII. CONCLUSION

With a better system of purchasing types of cakes, the customers will purchase cakes from the bakery because are providing their needs. Customers will not leave you unless they would be facing some difficulties such as size of the cakes, qualities and the price. The competition between bakeries today is forcing customers to give discount for the cakes. Without any discounts and lower qualities, it is difficult to safe loyalty customers in the modern era in today’s world. You should have especial products for the Masjid and The Month of Ramadan as well as for all Muslim people throughout the world. Therefore, reduce the fat in some baked goods by replacing up to half the fat with fruit or bean purees. In the future the company will serve all over the world for those who want halal Cakes to celebrate their happiness with their families and relatives. And the future plan include Finance, marketing, HR, operation aspects to start with Bakery business.
REFERENCES

[1] Jayaraman, K., Munira, H., Chowdhury Dababrata and Iranmanesh, M. 2013. The preference and consumption of chicken lovers with race as a moderator-an empirical study in Malaysia

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Abstract: This study sought to determine whether leadership style, remuneration, promotion, training and work environment influence retention of health workers in the public sector. A cross sectional survey of the health workers was conducted in Kenyatta National Hospital. A total of 400 questionnaires were distributed to the respondents. Multistage sampling was adopted in which case stratified sampling was used in the first stage to ensure all categories of health workers are represented. Simple random sampling was used in the second stage. Participants from the Focus Group discussion groups were drawn from the five distinct categories of health workers as classified by World health organization. Key informant interviews were conducted for each head of division (Deputy Director) to get in depth information on retention but one declined to be interviewed. Data collected was analyzed using descriptive statistics and presented in form of graphs. Based on the findings of this study, this research concluded that leadership style influences health workers’ retention in Kenyan National Hospital. It was further concluded that remuneration for the health workers did influence their retention. Training offered also influenced the health workers’ retention rate. Promotion influenced health workers’ retention in Kenyatta National Hospital. It was recommended for hospitals to improve on non-monetary incentives like recognitions. Fair remuneration was also recommended for increased motivation and stability of health workers. Training of health workers’ staff was recommended as a way of boasting health workers’ skills and knowledge which serves as an intrinsic motivation to the health workers as well. Both promotion and training policies should be adhered to in order to create a sense of organizational justice among the health workers. A similar but cross sectional survey study was acknowledged and recommended as an area of further research in the public hospitals in Kenya especially now that the health function has been devolved.

Key Terms: Staff retention, Leadership Style, Remuneration, Promotion, Training, Work Environment

1. Introduction
In the Kenyan public sector, employee retention is one of the most critical issues facing organizational managers as result of skilled manpower, economic growth, and high employee turnover (Michael, 2008). Good workforce retention is vital to ensuring well-functioning health services capable of delivering improved health outcomes. Longer duration of employment may be associated with increased experience, local knowledge, and skills, and provides continuity of service and care. New staff members are not optimally productive until fully inducted into the workplace (Humphreys & Wakeman, 2009).

A prerequisite for a well-functioning health system is a well-motivated staff. Low level of health worker motivation has often been identified as a central problem in health service delivery among existing human resources. Motivation and retention are major concerns in human resources for health (HRH). Health workers are susceptible to push factors such as pay and working conditions and pull factors such as job satisfaction and economic prospects.

Ensuring that staff receives adequate pay for their work is vital to their retention. However, it is not just salary that is important. In many contexts, the low numbers of trained health staff in remote areas is due to the lack of supporting infrastructure and opportunities for staff and their families. In fragile contexts, these factors include poor living conditions, the lack of safety and security in the workplace, and the absence of continuous professional development (Global Health Magazine, 2010).

Kenya currently faces several HRH related challenges. HRH ratios in Kenya fall below the WHO recommended standards, for example, the WHO recommended staffing levels for key health workers (doctors, nurses, and midwives) is 2.3 per 1000 population as compared to Kenya’s 1.5 per 1000 population. In 2008, the Ministry of Health had 33,317 filled positions out of the approved required number of 47,247; an overall vacancy level of 29% as compared to 2006 when 35,627 positions were filled out of an establishment of 44,8135. Retirement has previously been cited in the Human Resources for Health Strategic Plan 2009-2012 as the major cause of attrition with the attendant imbalance in the equitable distribution of HRH, especially in public sector.
However, with the increase of the public sector retirement age in 2007–2008 from 55 to 60 years, there is hope that attrition due to retirement will improve, although migration and streamlining of public sector employment in line with the new constitution has presented new challenges with regard to equitable distribution. (MoH, 2009)

With regard to quality health care services, it is estimated that in Kenya, US$65,997 is spent educating one medical doctor from primary school to university and for every doctor who emigrates US$517,931 returns on investment are lost, seriously undermining the quality of HRH work force (Kirigia et al., 2006). Kenya has been trying to improve the functioning of the health care delivery system to ensure that the general population receives quality services. Towards this end, the Government launched the first ever National Human Resources for Health Strategic Plan 2009-2012 in 2009. This strategic plan has five projected outcomes: appropriate numbers and types of health workers in post and equitably distributed, retention of health workers improved at all levels, improved institutional and health worker performance, strengthened human resources development systems and practices and strengthened human resources planning and management.

The strategic plan identifies retention as a major concern as health workers continue to leave the subsector and sector especially the highly mobile cadres of doctors and nurses and the problem is acuter in remote/hard to reach areas. The plan, therefore, prioritizes improved attraction and retention of health workers as one of the anticipated outcomes. The Human Resources for Health Strategic Plan 2009-2012. ROK (2009) summarizes the situation of the health workforce in Kenya. Out of a total establishment of 47,247 positions in 2008, the Ministry of Health had 33,317 positions occupied. Between 2004 and 2008, however, the number of staff employed by the Ministry of Health declined significantly. During the same period the population increased by 7%, implying a decline in coverage. A number of development partners (such as the US-funded Capacity Project) have supported the recruitment of the health workforce. This number of contract staff is significant – it represents the equivalent of increasing the MOH workforce by 10%.

The global shortage of health workers is estimated to be around 2.3 million physicians, nurses and midwives, and over 4 million health workers overall (WHO, 2009). Regional disparities exist between countries within Sub-Saharan Africa requiring an almost 140% increase in the health workforce in order to overcome the crisis of the health workforce. HRH ratios in Kenya fall below the WHO recommended standards, for example, the WHO recommended staffing levels for key health workers (doctors, nurses and midwives) is 2.3 per 1000 population as compared to Kenya’s 1.5 per 1000 population. In 2008, the Ministry of Health had 33,317 filled positions out of the approved required number of 47,247; an overall vacancy level of 29% as compared to 2006 when 35,627 positions were filled out of an establishment of 44,8135.

The management of the KNH attributes the shortage of various kinds of experts to; high turnover of those hired due to the Hospital’s unattractive scheme of service and poor working conditions; and the long training periods required to acquire skills in specialized healthcare delivery. The management said the Hospital perennially loses staff to other hospitals and institutions in the country and abroad because it does not offer them competitive terms of employment and an attractive working environment (Auditor General, 2012).

There have been a number of studies in the United States and Canada showing that the risk to the patient increases when the number of qualified personnel decreases (Ndetei, Khasakhala, & Omolo, 2008). Kenya's health system faces a variety of human resource problems, primarily an overall lack of personnel in key areas, which is worsened by high numbers of trained personnel leaving the health sector to work overseas. Furthermore, those personnel who remain are inequitably distributed between urban and rural areas (Dambisya, 2007).

The distinction between retention and turnover is important because we need to measure what we want (retention) instead of what we don’t want (turnover). Retention should be the focus because an experienced employee is more valuable than a newly-hired one. Where the workforce is experienced the quality of care is better due to fewer errors, and long-term employees minimize the cost of reduced productivity.

Migration of qualified doctors and nurses from Kenyatta national hospital to the private sector and other countries has resulted to shortage of medical personnel in this hospital. Research shows that up to three quarters (75%) of doctors do leave the government employment three years after joining the public health sector to join either the private health sector or travel abroad to seek a better employment (Mwenda, 2012).

The general objective of this study was to investigate the factors influencing health workers retention in Public Health Sector in Kenya: a case study of Kenya National Hospital. The specific objectives were to determine the influence of leadership style on retention of health workers in Kenyatta National hospital, to establish the influence of remuneration on retention of health workers in Kenyatta National Hospital, to establish the influence of training on retention of health workers in Kenyatta National Hospital, to establish the influence of promotion on retention of health workers in Kenyatta National hospital and to establish the influence of work environment on retention of health workers in Kenyatta National hospital.
2. Literature Review

2.1 Theoretical Literature

2.1.1 Human Capital Theory
The human capital theory was proposed by Schutz (1961) and developed extensively by Becker (1964) and the theory posits that the knowledge and skill a worker has generated a certain stock of productive capital. This approach also sees people, not as an expense item on their income statements, rather as an asset capable of not only adding value to their organizations but also in some cases ensuring its very survival in the current competitive environment (Sutherland, 2004).

Human capital comprises intellectual capital (which are the unique knowledge and skills that people possess), social capital (which is flexible networks among people that allow the organizations to link, embed and leverage its diverse knowledge) and the organizational capital (which is the institutionalized knowledge possessed by an organization that is stored in databases and manuals). Sutherland (2004) also adds emotional capital which is the ability to convert the potential in intellectual capital into committed realized action. According to Stewart (1998) in Sutherland (2004), a significant amount of an organizations value is possessed by its employees and when the key employees leave companies, they take this value with them. It is indeed the knowledge, skills, and abilities of individuals that create value, which is why the focus has to be on means of attracting, retaining, developing and maintaining the human capital they represent.

2.1.2 Expectancy Theory
Vroom (1964) was the first to develop an expectancy theory with direct application to work settings, which was later expanded and refined by Porter and Lawler (1968) and others (Pinder, 1987). Expectancy theory is based on four assumptions (Vroom, 1964). One assumption is that people join organizations with expectations about their needs, motivations, and past experiences. These influence how individuals react to the organization. A second assumption is that an individual’s behaviour is a result of conscious choice. That is, people are free to choose those behaviours suggested by their own expectancy calculations. A third assumption is that people want different things from the organization (e.g., good salary, job security, advancement, and challenge). A fourth assumption is that people will choose among alternatives so as to optimize outcomes for them personally. (Lunenburg, 2011)

According to turnover and retentions frameworks developed from this theory, decisions to stay or leave an organization can be explained by examining relationships between structural, psychological and environmental variables. The theory suggests that organizational members have certain expectations for the structural properties of work (Price, 2001). Daly et al. (2006) surmise that for faculty members, these structural expectations may include collegial communication, equitable rewards, work autonomy, job security, and a role in organizational decision making. It posits that when these structural expectations are met, faculty members will report higher levels of job satisfaction and stronger commitment to the employing organization, which in turn strengthen intent to stay. Conversely, when structural expectations are not fulfilled, levels of satisfaction and commitment decline, and intent to leave increases. In this way, perceptions of organizational structures affect psychological dispositions toward staying or leaving the institution.

2.1.3 Herzberg’s two-factor Theory
Herzberg (1959) argued that employees are motivated by internal values rather than values that are external to their work. On empirical studies, an attempt was also made to apply Herzberg’s motivational and hygiene factors to recruiting and retaining technical personnel at a U.S Department of Energy site (Tamosaitis & Schwenker, 2002). Consistent with the two-factor theory, the authors found that hygiene factors are a major factor influencing turnover and that the work itself provides job satisfaction, but they also found an emphasis on hygiene as a retention factor which was inconsistent with Herzberg’s theory.

Also relating the two-factor theory to retention, Udechukwu (2009) studied turnover among correctional officers using the two-factor theory as a frame of reference. This is a field that suffers from a high level of turnover, and the author suggests that it is due to “less-than-hospitable” conditions on the job, impacting hygiene factors among these employees (Udechukwu, 2009). The author concluded that because of these hygiene factors, the field will always be plagued by high turnover which can only be combated with deliberate and aggressive attempts to create defined career paths and feasible promotional opportunities for its officers (Udechukwu, 2009). Studies (Sutherland, 2004; Netswera et al., 2005; Radivoev, 2005; Michael, 2008) indicate that extrinsic factors (competitive salary, good working environment, job security) and intrinsic factors (training, development and challenging work) influence employee retention in organizations. This is consistent with Herzberg’s two factor theory focusing on intrinsic and extrinsic factors.
2.2 Conceptual Framework

![Conceptual Framework Diagram]

2.3 Empirical Review

Mudhune (2009) conducted a study to determine policies to improve nurse recruitment and retention in rural Kenya. The study has identified a number of job attributes that can be directly influenced by health policy in order to increase attraction to rural postings. These include: permanent contracts linked to rural posts, allowances, opportunities for training and reduced years of experience before being promoted. These results show that nurses place the highest value on attributes that would be expected to have immediate monetary advantages such as salary enhancement or long term factors (promotion, training, and permanent contract).

Snow et al. (2011) investigated the factors related to low retention of health workers. The study established that for doctors, although salary is important, the career development concerns keep them in urban areas. The study also showed that short-term service in rural areas was preferable if it was linked to coaching and mentoring, as well as career growth.

A study by the Regional Network for Equity in Health in East and Southern Africa (EQUINET), sought to investigate the causes of migration of health professionals, the strategies used to retain health professionals, how they are being implemented, monitored and evaluated, as well as their impact, to make recommendations to enhance the monitoring, evaluation, and management of non-financial incentives for health worker retention. It revealed that all four countries studied (Swaziland, Zimbabwe, Tanzania, and Kenya) have put in place strategies to improve morale and retain staff in the public health sector. Nevertheless, it raised caution about approaches that target specific groups. The study pointed to cadres that appear to have been excluded from incentive...
strategies, particularly those cadres that work at community level and that form a bridge to other actors who play a role in primary health care, such as traditional health providers and community health workers (Dambisya, 2007).

According to Chankova, Muchiri & Kombe (2009), several reasons explain attrition of health workers in Kenya. These include retirement, resignation, and death. Appropriate policies to retain staff in the public health sector may need to be tailored to different cadres and level of health facility are therefore required. An ethnographic study on attrition among community health workers in home based care (HBC) programmes in Western Kenya.

The question of retention of health workers has also been addressed in a study in Malawi by Manafa et al. (2009). Results from the investigation show that continuous education and progressive career growth are inadequate. Standard HRM practices such as performance appraisal and job descriptions were not present. Health workers felt that they were inadequately supervised, with no feedback on performance. However, managers did not perceive these deficiencies as having an impact on motivation. The study concludes that a strong HRM unit operating at the district level in Malawi is likely to improve worker motivation and performance.

Gilles et al. (2014) researched on factors associated with health care professionals’ intent to stay at Lausanne University Hospital in Switzerland among five categories of hospital staff namely laboratory, administrative, psycho-social workers, nurses and care givers, physicians they identified several factors that affect hospital professionals’ intent to stay. By studying this issue across five distinct professional groups, they were able to identify its determinants and depict their roles in each professional group, thereby highlighting important aspects that could be more specifically targeted in future interventions. The determinants were manager characteristics (respect and availability), organizational characteristics (workload, career opportunities, and working conditions) and work characteristics (work organization and co worker support). They also highlighted that intent to stay could be approached at a hospital level through a global strategy and hospital governance and at a professional group level through more tailored interventions (Gilles et al., 2014)

2.4 Critique of Existing Literature and Research Gaps
The significance of health workers in a country development agenda cannot be over emphasized. The world is experiencing a shortage of health workers. Previous studies (Humphreys & Wakeman 2009, Manafa, ea tl, 2009, Mbindyo, ea.tl, 2009 and Zarebski, 2012) have focussed on rural and remote area. This limits the generalization of research findings as rural settings are different from urban settings and factors influencing the health workers intent to stay are therefore different.

On a global scale, the focus has been on doctors and nurses. The success of health sector is influenced by allied medical workers as doctors and nurses do not perform their duties in isolation (Gilles, Burnand & Peytremann-bridevaux, 2014). This again limits generalizing the findings as different categories of staff have different needs and the focus on doctors and nurses has influenced policies formulation which has led to unintended consequences of de motivating the other categories of staff.

Obura (2014) focused on turnover of health workers. From previous research the reasons why health workers leave the organization are not the same reasons why they stay for e.g. if employees leave for better pay it does mean those who remain are better paid. This research will focus on factors influencing why health workers stay across the professionals in a public sector. Both qualitative and quantitative sources of data will be used.

Millennium Development Goals (MDGs) the precursor of Sustainable Development Goals These global goals, prominently featuring health, have become a focal point for rallying international cooperation to achieve time-bound targets. Emerging are many new programmes, mechanisms, financing strategies, and actors. To take advantage of these opportunities, a strong and vibrant health system is essential. Yet, such systems are impossible without health workers who are the ultimate resource of health systems. Yes, money and drugs are needed, but these inputs demand an effective workforce: for it is people, not just vaccines and drugs, who prevent disease and administer cures. Workers are active— not passive—agents of health change. Often commanding two-thirds of health budgets, they glue together the many parts of health systems to spearhead the production of health. Evidence shows that human force drives health-system performance (Chen et al., 2004).

Most studies have focused on health care workers turnover and not retention. Few studies have been conducted on factors influencing why health care workers stay. Over the years the focus has been on nurses and other professionals allied to medicine have not been considered in empirical researches done across the globe. In Africa research has concentrated on retention of health workers in rural and remote areas but not migration that occurs between the public sector and the private sector in urban settings which also interferes with the health system as the targeted population is different. Hospital care involves a series of interdependent providers, but the published literature mostly focuses on nurses’ intent-to-stay determinants without considering other professional categories. Variations in intent to stay among professional groups may shed light on underlying mechanisms, as well as those specific to professional groups or those more particularly linked to institutional context or culture (Gilles et al., 2014)

3. Research Methodology
A case study research design was adopted for this study. A case study is a research methodology common in social science. It is based on an in-depth investigation of a single individual, group, or event to explore causation in order to find underlying
principles. Yin (2004) defined case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used (Yin, 2004).

The population of the study was the non clinical and clinical staff employed by Kenyatta National hospital either on contract or permanent and pensionable. The total number was 4955 (KNH, 2012). The employees employed on casual and temporary terms are likely to leave the organization. Kenya

The KNH establishment formed the sampling frame. By using the establishment all employees of Kenyatta national hospital shall have an equal chance of being selected for the sample. Kenyatta National hospital has more than 6000 employees but the target population is 4,955(Ministry of Medical Services, 2012)

Multistage sampling was adopted in which case stratified random sampling using designation was used in the first stage to ensure representation of the subgroups constituting health workers in Kenyatta National hospital. In the second stage, simple random sampling was used to arrive at the required sample of 10% of the target population. The total sample size was calculated using published tables. The total sample size was 400 distributed as follow:

<table>
<thead>
<tr>
<th>Table 3.1 Sample Size the of Target Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of staff</td>
</tr>
<tr>
<td>Medical officers and specialists</td>
</tr>
<tr>
<td>Dentists</td>
</tr>
<tr>
<td>Pharmacists</td>
</tr>
<tr>
<td>Nurses</td>
</tr>
<tr>
<td>Clinical Officers</td>
</tr>
<tr>
<td>Lab techs</td>
</tr>
<tr>
<td>Pharm. technologists</td>
</tr>
<tr>
<td>Radiographers</td>
</tr>
<tr>
<td>Nutrition officers</td>
</tr>
<tr>
<td>Physiotherapists</td>
</tr>
<tr>
<td>Occupational therapists</td>
</tr>
<tr>
<td>Medical record officers</td>
</tr>
<tr>
<td>Public Health Officers</td>
</tr>
<tr>
<td>Other professional staff</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Primary data was collected by use of one main structured questionnaire that captures the various variables of the study. The questionnaire was designed to address specific objective and research questions. A questionnaire having both closed - ended and open - ended questions was administered to health workers in KNH. The closed ended items give precise information which minimizes information bias and facilitate data analysis. Some items from the questionnaire were modified from Ngethe (2013) and Ojaka, Olang & Jarvis (2014).

Focused group discussions were held. The clinicians and non clinicians each had a separate focus group discussion. Kenyatta hospital has three deputy directors. Each deputy director was interviewed except one who declined. Secondary data was obtained from literature sources or data collected by other people for some other purposes. Secondary data was collected through review of published literature such as journals articles, published theses, textbooks, World Health organization (WHO) reports, nongovernmental organizations reports and Audit reports by other government ministries, departments and agencies.

The researcher obtained permission from the University, KNH-UoN Research and Ethics Committee, Kenyatta National Hospital and National Commission for Science and Technology. A research assistant was recruited to assist in administering the questionnaires. The researcher organized two focus group discussions one for clinicians and the other for non clinicians.

A pilot study was undertaken for pre-testing the questionnaire. The questionnaire was edited in the light of the results of the pilot study. The pilot study reveals the weakness of the questionnaire if any (Kothari, 2004). The researcher conducted a case study of Thika level Five Hospital. Piloting enabled the researcher to ascertain the validity and reliability of the instrument. Validity is the extent to which a scale or set of measures accurately represents the concept of interest. Only 5 employees of Thika Level Five hospital were pilot tested. The staffs piloted were from the highly mobile cadres of doctors and nurses.

The raw data was entered into Statistical Package for Social Scientists (SPSS) where further analysis was done. Descriptive statistics was used to answer the research questions and the objectives of the study. In addition to calculating the mean and the standard variation of the variables of the study, results from the analysis were presented in tables and graphs for ease of

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interpretation and understanding. The descriptive statistics provided the basic feature of data collected on variables and provided the impetus for further analysis.

Questions which were used to collect qualitative data were being aligned to the research objectives. The responses were summarized into most occurring in categories according to research objectives. These qualitative findings were integrated with the quantitative findings in discussions. N VIVO which is computer software for analyzing qualitative data was used.

According to Mugenda and Mugenda (2003), correlation technique is used to analyze the degree of relationship between two variables. The computation of a correlation coefficient yields a statistic that ranges from -1 to +1. This statistic is called a correlation coefficient (r) which indicates the relationship between the two variables and the bigger the correlation the stronger the coefficient between the two variables being compared. The direction of the relationship is also important in that if it is positive (+), it means that there is a positive relationship between the two variables and this means that when one variable increases the other variable increases or when one variable decreases the other variable also decreases. A negative relationship (-) means that as one variable decreases the other variable increase and vice versa and hence an inverse relationship. If there is no relationship, the coefficient is equal to zero. Pearson’s Product - moment correlation coefficient was used to determine the strength and the direction of the relationship between dependent variable and the independent variables.

4. Findings, Conclusions and Recommendations

4.1 Response Rate

The percentage of people who responded to the survey was 68.5% as a total of 400 questionnaires were administered out of which 274 people submitted a completed survey. Acceptable response rates vary depending on how the survey was administered. In this study the response rate is considerably good and therefore the data can be used to produce accurate and useful results that are representative of the target population.

4.2 Personal Information

4.2.1 Gender

Out of the 266 study participants 45.1% (n=120) were male while a majority of 54.9% (n=146) were female. This preponderance is the result of the significant weight of the nurse categories, which are traditionally female-oriented occupations in Kenya and around the globe. Incidentally, more than 73% of all Kenya registered community health nurses in the public market in Kenya and 62% of all Bachelor of Science nurses are women (Ministries of Medical Services and Public Health and Sanitation 2013). For other health care worker categories such as physicians, physiotherapists, dentist and dental technologists, public health officers and technicians, however, men are in the majority. This is in line with MoH (2012) findings that women are not well represented in the medicine field. In similar studies conducted the females are more than males especially in lower cadres. A study conducted by Amref in three counties namely Machakos, Turkana and Machakos, out of a total of 404 participants enrolled to the study distributed across three regions namely Nairobi (171) Machakos (135), and Turkana (98). The study recorded a total of 234 (57.9%) females as compared to 170 (42.1%) males. This favorably compares with the results of this study.

Most health care workers in the public market in Kenya are women. In 2013, for instance, of the 31 060 health care workers in the public sector, women represent nearly 60% of all personnel in the national health system. This preponderance is the result of the significant weight of the nurse categories, which are traditionally women-oriented occupations in Kenya. Incidentally, more than 73% of all Kenya registered community health nurses in the public market in Kenya and 62% of all BSc nurses are women. The feminization of the health workforce implies challenges in terms of managing human resources, especially reconciling the maternity constraints and administrative provisions such as family reunification with the requirements of providing services. Measures such as task shifting and the use of temporary personnel should be carefully explored in an attempt to overcome this constraint.
4.2.2 Age

The majority of the respondents 40.3% (n=110) were between the ages of 40-49 years while the those of ages less than 30 years were the least with a percentage of15.8% (n=43). This suggests that the public health sector has an ageing workforce which is mainly as a result of the many years Kenya had a civil service employment freeze before 2013. The employment freeze was largely as a result of the Structural Adjustment Program advocated by the World Bank. It resulted in a long-term decline in the number of civil servants, including health workers; this is now being reversed. From the table, the median of 42 years compares with MoH 2012 report. The majority of the employees in Kenyatta National Hospital which is at the apex of the health care may have attracted the employees to stay because of her location and existing and or perceived opportunities. In a similar study conducted by Onyango (2012), Out of a total number of 357 respondents who participated, majority 132 (37.0%) were aged between 30 to 39 years. This was closely followed by 128 (35.9%) who were aged 40 to 49 years, 60 (16.8%) were 50 years and above. There was a notable 37 (10.4%) young employees aged between 20 to 29 years. Since the study was conducted four years apart this may explain the difference.

Table 4.1 frequency and percentage Distribution of the respondents’ age

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30</td>
<td>43(15.8%)</td>
</tr>
<tr>
<td>30-39</td>
<td>66(24.2%)</td>
</tr>
<tr>
<td>40-49</td>
<td>110(40.3%)</td>
</tr>
<tr>
<td>More than 50</td>
<td>54(19.8%)</td>
</tr>
</tbody>
</table>

4.2.3 Health Qualifications

Table 4.2 shows the frequency and percentage distribution of the health qualifications of the study participants. 26.5% had attained diploma which was equivalent to those with a bachelor’s degree. Ph.D. holders were the least with a percentage of 0.4 (n=1).The data shows that a vast majority (89.1%) of MOH’s professional health workers hold secondary school education. However, the IPPD data do not National HRH State who hold certificates and diploma from these colleges are still categorized as having secondary school education.

The research finding compares favorably with a AMREF(2012) research which was conducted in three counties namely Turkana, Machakos and Nairobi and revealed that 80.2.1% of health workers had post secondary education, In Nairobi county where Kenyatta National Hospital is located 90.6 had post secondary education.
4.2.5 Marital Status

According to the study findings, 70.5% (n=191) of the participants were married monogamous followed by those who were single with a percentage of 19.9 (n=54). This is evident because majority of the respondents were elderly therefore likely to be married. This compares favorably with AMREF(2012) study which found that 67.3% of health workers in Nairobi county are married. KNH health workers are part of the subset of health workers in Nairobi county.

4.2.5 Experience Of Health Workers In Current Places Of Work
33% (n=65) of the respondents had been in Kenyatta National Hospital for more than 20 years whereas a small percentage of 3.1% (n=6) had been in the hospital for less than 1 year. In health professionals one becomes better with age and experience and supervision has been cited as one of the reasons health workers stay in a station and since KNH has all categories of health workers, supervision is not a problem for junior employees in all cadres.

Table 4.2 Distribution of the workers experiences in current place of work

<table>
<thead>
<tr>
<th>Period</th>
<th>N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than a year</td>
<td>6(3.1%)</td>
</tr>
<tr>
<td>1-4 years</td>
<td>42(21.5%)</td>
</tr>
<tr>
<td>5-9 years</td>
<td>21(10.8%)</td>
</tr>
<tr>
<td>10-14 years</td>
<td>20(10.3%)</td>
</tr>
<tr>
<td>15-19 years</td>
<td>41(21.0%)</td>
</tr>
<tr>
<td>20 and above years</td>
<td>65(33.3%)</td>
</tr>
</tbody>
</table>

4.2.6 Current Designation

The majority of the clinical staff were nurses 29.2% (n=78). Further cross tabulation of designation against gender revealed that 79.2% (n=61) were female whereas 20.8% (n=16) were male. In health sector nurses form a significant number of employees especially among clinical staff while Specialists are few.

Table 4.3: Distribution of the respondents’ Designation

<table>
<thead>
<tr>
<th>Designation</th>
<th>N(%)</th>
<th>Designation</th>
<th>N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians</td>
<td>5(1.9%)</td>
<td>Occupational therapists</td>
<td>3(1.1%)</td>
</tr>
<tr>
<td>Clinical officers</td>
<td>3(1.1%)</td>
<td>Orthopedic technologists</td>
<td>3(1.1%)</td>
</tr>
<tr>
<td>Medical lab technologists</td>
<td>5(1.9%)</td>
<td>Pharmacists</td>
<td>6(2.2%)</td>
</tr>
<tr>
<td>Dentists</td>
<td>2(0.7%)</td>
<td>Pharmacy technologists</td>
<td>11(4.1%)</td>
</tr>
<tr>
<td>Community oral health</td>
<td>1(0.4%)</td>
<td>Physiotherapists</td>
<td>7(2.6%)</td>
</tr>
<tr>
<td>Health record-keeping</td>
<td>26(9.7%)</td>
<td>Nutritionists</td>
<td>3(1.1%)</td>
</tr>
<tr>
<td>Environmental health technologists</td>
<td>3(1.1%)</td>
<td>Medical educationists</td>
<td>7(2.6%)</td>
</tr>
<tr>
<td>Radiographers</td>
<td>1(0.4%)</td>
<td>lab technologists</td>
<td>3(1.1%)</td>
</tr>
<tr>
<td>ECG technologists</td>
<td>1(0.4%)</td>
<td>Professionals in other programs</td>
<td>99(37.1%)</td>
</tr>
<tr>
<td>Nurses</td>
<td>78(29.2%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2.7 Sources of Income

Almost half of the population sampled 46.0% (n=125) did not have any other source of income apart from their salaries while 28.7% (n=78) practiced farming in addition to formal employment. Other sources of income included lecturing and free lancing. A significant percentage is not engaged in any other income generating activity due to the nature of their work and availability of time. This explains why health workers are always demanding pay increase.

Figure 4.3: Sources of income

4.2.7.1 proportion of Total Income

Majority of the respondents 57% (n=73) reported that their salary was the only contribution to their income.
4.4 Role of Remuneration in Retention of Health Workers

The following are findings on the importance of compensation factors offered by an organization. It is interesting to note that health care for one’s family was ranked as the most important compensation factor, 87.5% (n=230) followed closely by salary at 81.9% (217) then terminal benefits such as retirement and pension. Family health care, salary, and terminal benefits are important compensation factors that are closely linked to motivation and retention. Health workers place emphasis on family care; compensation is highly regarded if it has a direct benefit to dependents. Health care to families is even ranked higher than salary among health workers. The majority of health workers are in their mid-years and married with children. Compensation to them transcends individual interest to include greater benefits for dependents. This has potential policy implications for recruitment and compensation (AMREF 2012)

Table 4.4: Frequency and Percentage Distribution of Remuneration Compensation Factors

<table>
<thead>
<tr>
<th>Remuneration</th>
<th>N (%)</th>
<th>Important</th>
<th>Somewhat important</th>
<th>Not important</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Salary</td>
<td>217(81.9%)</td>
<td>43(16.2%)</td>
<td>5(1.9%)</td>
<td>-</td>
</tr>
<tr>
<td>ii. Terminal benefits (retirement pension etc.)</td>
<td>194(73.5%)</td>
<td>59(22.3%)</td>
<td>8(3.0%)</td>
<td>3(1.1%)</td>
</tr>
<tr>
<td>iii. House allowance/allocation of a house to stay</td>
<td>168(63.6%)</td>
<td>82(31.1%)</td>
<td>11(4.2%)</td>
<td>3(1.1%)</td>
</tr>
<tr>
<td>iv. Assistance with transportation</td>
<td>111(43.0%)</td>
<td>93(36.0%)</td>
<td>36(14.0%)</td>
<td>18(7.0%)</td>
</tr>
<tr>
<td>v. Health care for my family</td>
<td>230(87.5%)</td>
<td>29(11.0%)</td>
<td>3(1.1%)</td>
<td>1(0.4%)</td>
</tr>
<tr>
<td>vi. Extraneous allowance/top up salary</td>
<td>181(61.3%)</td>
<td>64(24.5%)</td>
<td>13(5.0%)</td>
<td>3(1.1%)</td>
</tr>
</tbody>
</table>

4.4.1: Findings on the Role of Remuneration on Health Workers Retention.

The majority of the respondents (59.1%) disagreed that they were satisfied with the amount of salary they earned for their work, whereas 15.6% were satisfied. The respondents disagreed that their hospital offers attractive allowances to the health staff (39.6%). Most of the respondents disagreed (79.5%) that the hospital provides regular salary supplements. The further majority (74.0 %) disagreed that financial incentives such as bonus are allocated fairly and in a transparent manner. Of the respondents, 38.4% indicated that they were not satisfied with the amount of salary they earn compared to other employees in other organizations with similar qualifications.

Personnel compensation takes a substantial amount of government spending on health: 80%. The private hospitals pay relatively higher basic salaries than the government-owned hospitals. Nurses and technicians earn less than half the highest wage, which is
earned by medical officers and specialists, dentists and radiologists. Although the medical officers earn the highest salary, this remains very low compared with international salaries, showing the poor competitiveness of Kenya on the international health labour market.

Figure 4.5: Rate of Remuneration Satisfaction

Table 4.5: Frequency and percentage distribution of remuneration statements

<table>
<thead>
<tr>
<th>Statement</th>
<th>N (%)</th>
<th>Strongly Agree</th>
<th>agree</th>
<th>Neutral</th>
<th>disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. The salary I earn is adequate to meet my desired needs and aspirations</td>
<td>3(1.1)</td>
<td></td>
<td>70(25.7)</td>
<td>78(28.7)</td>
<td>87(32.0)</td>
<td>34(12.5)</td>
</tr>
<tr>
<td>ii. I am satisfied with the amount of remuneration I receive for my work</td>
<td>2(0.7)</td>
<td></td>
<td>40(14.9)</td>
<td>68(25.3)</td>
<td>116(43.1)</td>
<td>43(16.0)</td>
</tr>
<tr>
<td>iii. The hospital offers attractive allowances (House, travel, leave etc.) to health workers</td>
<td>11(4)</td>
<td></td>
<td>77(28.1)</td>
<td>75(27.4)</td>
<td>72(26.3)</td>
<td>30(10.9)</td>
</tr>
<tr>
<td>iv. Salary raises are regular in this hospital</td>
<td>5(2.0)</td>
<td></td>
<td>46(18.5)</td>
<td>51(20.5)</td>
<td>89(35.7)</td>
<td>58(23.3)</td>
</tr>
<tr>
<td>v. I am satisfied with the amount of salary I earn compared to other employees in other organizations with similar qualifications</td>
<td>13(4.9)</td>
<td></td>
<td>89(33.5)</td>
<td>69(25.9)</td>
<td>65(24.4)</td>
<td>30(11.3)</td>
</tr>
<tr>
<td>vi. I am satisfied with the amount of salary I earn compared to other health workers in this Hospital with similar qualifications</td>
<td>11(4.1)</td>
<td></td>
<td>65(24.3)</td>
<td>68(25.5)</td>
<td>83(31.1)</td>
<td>40(15.0)</td>
</tr>
<tr>
<td>vii. Salary raises are rare in this hospital</td>
<td>48(18.5)</td>
<td></td>
<td>73(28.1)</td>
<td>57(21.9)</td>
<td>59(22.7)</td>
<td>23(8.8)</td>
</tr>
<tr>
<td>viii. The hospital provides an adequate non-practicing allowance to supplement my loss of income from operating my own facility.</td>
<td>10(3.9)</td>
<td></td>
<td>12(4.7)</td>
<td>55(21.4)</td>
<td>83(32.3)</td>
<td>97(37.7)</td>
</tr>
<tr>
<td>ix. The remuneration in this hospital is competitive</td>
<td>16(6.1)</td>
<td></td>
<td>68(25.8)</td>
<td>83(31.4)</td>
<td>71(26.9)</td>
<td>26(9.8)</td>
</tr>
<tr>
<td>x. Overall the financial rewards I receive from this Hospital are fair</td>
<td>7(2.7)</td>
<td></td>
<td>77(29.3)</td>
<td>82(31.2)</td>
<td>57(21.7)</td>
<td>40(15.2)</td>
</tr>
<tr>
<td>xi. The hospital provides regularly salary supplements inform of bonus</td>
<td>7(2.6)</td>
<td></td>
<td>13(4.9)</td>
<td>35(13.1)</td>
<td>74(27.6)</td>
<td>139(51.9)</td>
</tr>
<tr>
<td>xii. Financial incentives such as bonus are reallocated fairly and in a transparent manner</td>
<td>5(1.9)</td>
<td></td>
<td>20(7.5)</td>
<td>44(16.6)</td>
<td>58(21.9)</td>
<td>138(52.1)</td>
</tr>
</tbody>
</table>

4.4.2 Perception whether Remuneration Increases Health Workers Retention

52.6% (n=141) of the participants indicated that remuneration given to health workers did increase their retention whereas 47.4% (n=127) indicated that it did not. When asked the rate at which remuneration increased health workers retention majority of the respondents, 36.3% (n=93) said 51-75% followed closely by 26-50% and 1-25% at 27.6%( n=70) and 26.8%( n=68) respectively.

4.4.3 Remuneration Areas Requiring Improvement to Enhance Health Workers Retention
The finding indicates that employees would appreciate Increase in salaries, bonuses, and allowances such as medical, leave, travel and holiday, overtime and night duty allowance. The financial incentives should be allocated in a fair and transparent manner.

Disparities in salaries should be reduced. There should be Fair remuneration of health workers regardless of professional cadre and provision of compensation for registrars on training. The two national hospitals namely the Kenyatta National Hospital and the Moi Teaching and Referral Hospitals heavily depend on registrars’ (both self sponsored and sponsored by employers in public/private) on training to provide health services. Unfortunately, the registrars work for lengthy periods without compensation.

According to a 2013 KIPPRA Study, Public Service pay is competitive at the state officers’ level and the bottom job groups of unskilled and semi-skilled workers. Although the Public Sector has become the employer of choice for the employees at the top and at the bottom of the remuneration and benefits structures, there is however, a challenge of attraction and retention of adequate numbers of competent technical and professional personnel in some sectors of the Public Service. In addition, there are parts of the country where there are challenges of deployment, attraction and retention of public servants due to the risks of personal safety and poor living conditions. This situation has compromised service delivery in the country.

Salaries have improved considerably since 1987 due to a re grading of KNH from Parastatal type D to a type B from July 1990. This put salaries two grades higher than the equivalent at the MOH and on a par with those at the public universities. With the increased salaries, KNH can now attract nurses away from the private sector. However, the hospital is less able to compete with the private sector for skilled staff in areas such as computers, finance, and information management.

According to Kippra report on Public–private wage differentials in Kenya, The mean wage across the various levels of education shows that individuals working in the private sector and who have no education earn an average Ksh 9,368, while those with a first university degree and post-graduate education earn an average Ksh 47,968 and Ksh 113,784, respectively. A similar analysis in the public sector shows that an individual with no education earns an average Ksh 16,916, whereas university graduates earn between Ksh 83,629 and Ksh 101,695, on average (KIPPRA, 2013).

4.5 Role of Work Environment on Retention of Health Workers

The majority of the study participants (69.4%) felt that they had job security this is in line with the findings that 88% of the sampled population were permanent and pensionable employees of Kenyatta National Hospital. A high percentage (53.0%) indicated that the facility had good access to drugs and medicines. However, 42.1% of the subjects felt that the workload at the hospital was not manageable. This could be related to greater staff shortages in Kenyatta National Hospital as observed in qualitative analysis during face-to-face interviews with key informants, and Focus Group Discussions (FGDs). In general working conditions at the hospital were ranked favorably compared to other factors such as remuneration.

The management sampled patients treated at the Hospital between September and December 2009 and found out that out of 168,417 patients attended to at the Hospital during the period, only 6,069 or 3.6% came on referral from other health facilities. Overall, Kenya has 16 doctors per 100,000 population and 153 nurses per 100,000 population compared to WHO recommended minimum staffing levels of 100 doctors and 356 nurses per 100,000 population. Only a third of these are in the public service. Effectively therefore a third of the doctors cater for 57% of outpatient visits and 64% of all admissions in the country. In addition, the Kenya health system exhibits mal-distribution of health workers. Although minimum staffing norms are clearly described, they are rarely used (Musyimi, 2013).

Otiende (2013) established that one of the biggest challenges facing health work force is lack of staff and lack of positive attitude among the staff. Health workers must fulfill their obligation as per the contracts. One of the key items in the Collective bargaining agreement (CBA) is on improving work environment. Work environment is critical to health workers as they cannot effectively perform their jobs without the necessary essentials. Lack of the basic essentials frustrates workers and they may consider leaving the hospital The Musyimi Report (2013) Improve working environment by providing well-lit, well-ventilated office space, office furniture, office equipment, and stationary for all doctors in the ministry within the next three years.

Good relationships among workers and working relationships between superiors and subordinates contribute to the retention of health workers as they form critical social support. This was evident during focus group discussions as camaraderie was exhibited and workers freely expressed themselves. The bond among themselves would make one re think of transfers. From the focus group discussions it was evident decisions made were mutually acceptable between superiors and subordinates. People join organizations but they quit managers.

The availability of social amenities encouraged health workers to stay in Kenyatta National Hospital which is located in Nairobi. Although Non government organizations pay better, most of the time you are posted in a rural setting which lacks social amenities like good schools for children e.t.c. Provision of housing facilities to clinical staff is a added advantage due to their nature of work.

Table 4.6 Frequency and percentage distribution of work environment statements

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<table>
<thead>
<tr>
<th>Work environment</th>
<th>N (%)</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. The workload is manageable</td>
<td>13(4.8)</td>
<td>92(33.9)</td>
<td>52(19.2)</td>
<td>55(27.7)</td>
<td>39(14.4)</td>
<td></td>
</tr>
<tr>
<td>ii. I have the supplies I need to do my job well and safely (gloves, needles, bandages, etc.)</td>
<td>22(8.3)</td>
<td>88(33.2)</td>
<td>72(27.2)</td>
<td>67(25.3)</td>
<td>16(6.0)</td>
<td></td>
</tr>
<tr>
<td>iii. I have the equipment I need to do my job well and efficiently e.g. ultrasound, x-ray, blood pressure cuffs</td>
<td>16(5.8)</td>
<td>90(32.8)</td>
<td>90(32.8)</td>
<td>56(20.4)</td>
<td>16(5.8)</td>
<td></td>
</tr>
<tr>
<td>iv. This facility has good access to drugs and medications.</td>
<td>26(9.8)</td>
<td>115(43.2)</td>
<td>80(30.1)</td>
<td>37(13.9)</td>
<td>8(3.0)</td>
<td></td>
</tr>
<tr>
<td>v. My job allows me to take to relax during the lunch break.</td>
<td>35(13.1)</td>
<td>110(41.0)</td>
<td>41(15.3)</td>
<td>53(19.8)</td>
<td>29(10.8)</td>
<td></td>
</tr>
<tr>
<td>vi. At my residence, I have access to safe, clean water</td>
<td>65(24.7)</td>
<td>151(57.4)</td>
<td>28(10.6)</td>
<td>13(4.9)</td>
<td>6(2.3)</td>
<td></td>
</tr>
<tr>
<td>vii. At work, I have access to safe, clean water</td>
<td>73(27.3)</td>
<td>154(57.7)</td>
<td>27(10.1)</td>
<td>10(3.7)</td>
<td>3(1.1)</td>
<td></td>
</tr>
<tr>
<td>viii. At residence, I have good access to electricity</td>
<td>84(31.3)</td>
<td>151(56.3)</td>
<td>26(9.7)</td>
<td>6(2.2)</td>
<td>1(0.4)</td>
<td></td>
</tr>
<tr>
<td>ix. At work, I have access to safe, clean water At work, I have good access to electricity</td>
<td>93(34.2)</td>
<td>153(56.3)</td>
<td>19(7.0)</td>
<td>6(2.2)</td>
<td>1(0.4)</td>
<td></td>
</tr>
<tr>
<td>x. I have access to good schooling for my children</td>
<td>39(14.6)</td>
<td>127(47.6)</td>
<td>65(24.3)</td>
<td>26(9.7)</td>
<td>10(3.7)</td>
<td></td>
</tr>
<tr>
<td>xi. I have safe and efficient transportation to work</td>
<td>33(12.2)</td>
<td>101(37.3)</td>
<td>64(23.6)</td>
<td>49(18.1)</td>
<td>24(8.9)</td>
<td></td>
</tr>
<tr>
<td>xii. I feel I have job security</td>
<td>47(17.9)</td>
<td>135(51.5)</td>
<td>50(19.1)</td>
<td>19(7.3)</td>
<td>11(4.2)</td>
<td></td>
</tr>
<tr>
<td>xiii. The community where I live has good shopping and entertainment</td>
<td>30(11.0)</td>
<td>120(44.0)</td>
<td>67(24.5)</td>
<td>38(13.9)</td>
<td>18(6.6)</td>
<td></td>
</tr>
</tbody>
</table>

4.5.2 Perception on Work Environment and Health Workers Retention

Most of the respondents 60.1% (n=161) agreed that work environment is a determinant for health workers retention whereas 39.9% (n=107) disagreed. On the rate at which work environment increases health workers retention 34.5% (n=90) indicated 26-50% followed closely by 33.7% (n=88) who indicated 51-75%. A high percentage, 69% (n=171) of the participants said that failure to improve work environment was one of the reason why employees would leave the hospital for employment elsewhere. Previous studies have established a link between intent to leave and staff turnover. This implies a staff turnover of about 20% within the next two years due to resignations alone. Health workers are likely to move from government to NGOs, private facilities and out of the country in search for better working environment. Poor working conditions: Long working hours, huge work load coupled with low job satisfaction are bound to result in employee lethargy eventually de-motivating health workers and impacting retention (AMREF, 2012)

The results of the study agrees with a study conducted in Kenya on the cost of training health professionals where the study concluded that the key push factors driving out health workers include: weak health systems; insecurity including violence at the workplace; poor living conditions; low remunerations; lack of professional development opportunities (e.g. continuing education or training); lack of clear career development paths; and risk of HIV infection due to lack of appropriate protective gear when handling specimens, blood and blood products; nepotism in recruitment and promotion; political unrest/civil wars; widespread poverty; poor governance; and case overload (Kirigia et al., 2006)

4.5.3 Nature of Employment Contract

Almost all, 88% (n=233) of the participants were permanent and pensionable employees of Kenyatta National Hospital.
4.5.4 Work Environment Areas to be improved to Enhance Health Workers Retention

The respondents recommended employment of more staff in order to reduce the amount of workload especially to the clinical staff. Focus group discussions established that patient’s nurse ratio did not meet the WHO standard. Related to this are Flexible working hours so that workers do not have to extend working hours. It was noted that clinical staff worked up to 16 hours during overnight shift.

The hospital should ensure that only referral patients are admitted for treatment in order to attain a favorable patient health worker ratio at the hospital seeing that Kenyatta National Hospital is ideally a referral hospital. The management sampled patients treated at the Hospital between September and December 2009 and found out that out of 168,417 patients attended to at the Hospital during the period, only 6,069 or 3.6% came on referral from other health facilities. The rest (96.4%) were walk-in patients. The sample study conducted revealed that lower-tier health facilities were capable of treating at least 60% of the ailments attended to at the Hospital.

4.6 Role of Training on Health Workers’ Retention

A high percentage of respondents 54.7% agreed that they were satisfied with training for their current job. This is in line with the analysis of the respondents on health qualifications since most of the respondents possessed either diploma or undergraduate degrees. On average, 35.7% disagreed that what is stated in the training policy is what is practiced always and a higher percentage 47.4% disagreed that fairness is practiced all the time in implementation of training policy. This was in tandem with the findings of the Public Inspection Committee Report (GoK, 2006) which established that training practices and policy were not implemented in a fair and transparent manner.

A percentage of 35.0% agreed that training opportunities outside the country influenced health staff to leave. This was corroborated through interviews for the directors of the hospital who indicated that those who went abroad for further studies especially to United States of America did not return.

Although majority were satisfied with the training practices in their institutions, on average 36.4% disagreed that the financial support is regularly given to attend conferences and workshops to enhance professional development (see Table 4.8). Professional development through conferences and workshops for health staff is crucial because it gives them forums to exchange ideas and keep abreast with current practices in their profession. Health workers thrive on intellectual and collegial stimulation from their peers when they attend professional activities and national and international research meetings in the ever changing field of medicine where new trends emerge daily.

As Armstrong (2009) asserts that career development is of importance to both to both the individual employee and to the organization individuals in an organization should be engaged in learning processes as they balance changing self and changing environment The government should provide health workers with training opportunities and timely promotions this can be done increasing budgetary allocation to the health sector

The Ministry is currently receiving Kshs 88 million per year against requirements of Kshs 386.7 million to develop competency among the staff to offer quality services. The shortage of specialist personnel has, therefore, been worsened by inadequate budgetary provision. vii Further, infrastructure development and the changing disease profiles have been inconsistently matched with human resource development with respect to specialists required to utilize the new infrastructure (Musyimi, 2013).
Training is one of the items contained in the Collective Bargaining Agreement (CBA) which has led to industrial action. Knowledge of in the health sector is dynamic and keeps changing. For the health professionals to be effective they have to be trained and update their existing knowledge. Acquisition of knowledge is an expensive affair and that is why they value hospitals that offer them training opportunities.

Table 4.7: Frequency and Percentage distribution of Training Statements

<table>
<thead>
<tr>
<th>Training</th>
<th>N (%) Strongly agree</th>
<th>agree</th>
<th>neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. The skills and knowledge learnt on the job in this hospital would transfer easily to most other similar organizations</td>
<td>100(37.0)</td>
<td>143(53.0)</td>
<td>16(5.9)</td>
<td>9(3.3)</td>
<td>2(0.7)</td>
</tr>
<tr>
<td>ii. I am satisfied with the training by the hospital for my present job</td>
<td>45(16.5)</td>
<td>104(38.2)</td>
<td>64(23.5)</td>
<td>45(16.5)</td>
<td>14(5.1)</td>
</tr>
<tr>
<td>iii. Training opportunities are offered regularly in this hospital</td>
<td>41(15.2)</td>
<td>110(40.7)</td>
<td>55(20.4)</td>
<td>46(17.0)</td>
<td>18(6.7)</td>
</tr>
<tr>
<td>iv. Financial support is regularly given by the hospital to attend conferences and workshops to enhance my professional growth</td>
<td>21(7.7)</td>
<td>93(34.2)</td>
<td>59(21.7)</td>
<td>60(22.1)</td>
<td>39(14.3)</td>
</tr>
<tr>
<td>v. The hospital readily invests in professional development for the health workers</td>
<td>34(12.5)</td>
<td>110(40.4)</td>
<td>76(27.9)</td>
<td>40(14.7)</td>
<td>12(4.4)</td>
</tr>
<tr>
<td>vi. What is stated in the training policy is what is practiced always</td>
<td>12(4.5)</td>
<td>70(26.0)</td>
<td>91(33.8)</td>
<td>73(27.1)</td>
<td>23(8.6)</td>
</tr>
<tr>
<td>vii. Fairness is practiced all the time in the implementation of training policy for the health workers</td>
<td>7(2.6)</td>
<td>56(20.6)</td>
<td>80(29.4)</td>
<td>84(30.9)</td>
<td>45(16.5)</td>
</tr>
<tr>
<td>viii. What is stated in the training policy is rarely practiced</td>
<td>23(8.6)</td>
<td>64(24.0)</td>
<td>90(33.7)</td>
<td>67(25.1)</td>
<td>23(8.6)</td>
</tr>
<tr>
<td>ix. This hospital has good training opportunities compared with other organizations</td>
<td>53(19.5)</td>
<td>112(41.2)</td>
<td>69(25.4)</td>
<td>29(10.7)</td>
<td>9(3.3)</td>
</tr>
<tr>
<td>x. Training opportunities outside the country influences staff to quit</td>
<td>39(14.7)</td>
<td>54(20.3)</td>
<td>74(27.8)</td>
<td>58(21.8)</td>
<td>41(15.4)</td>
</tr>
<tr>
<td>xi. I am satisfied with the training practices in this hospital</td>
<td>25(9.4)</td>
<td>76(28.5)</td>
<td>90(33.7)</td>
<td>50(18.7)</td>
<td>26(9.7)</td>
</tr>
</tbody>
</table>

4.6.1 Opinion on Whether Training Increases Health Workers Retention

A high percentage of respondents 62.1% (n=167) agreed that training offered to the health workers in their hospital increases their retention while 37.9% (n=102) disagreed. On their perception of the percentage increase resulting from training offered in the hospital, 37.1% (n=96) specified 26-50%. It was noted that 61.5% (n=144) of the participants were not of the opinion that lack of provision of adequate training by the hospital was one of the main reasons why health workers left for employment elsewhere.

The AMREF (2012) report on Education and Training observed that a smaller proportion in Turkana felt they have adequate training for their jobs. This compares to the low levels of education noted among health workers in Turkana. Lower levels of education and inadequate opportunities for upgrading has potential implications on the motivation of health workers in Turkana as majority feel they are not adequately prepared for their tasks. Health workers consider training as a significant reward and motivator. Inadequate skills among health workers therefore not only affects quality of services provided, but has direct implications on the motivation and retention of health workers. Education is identified as the fifth aspect of HRM systems in the HRH action framework with a focus on maintaining a skilled workforce. A comprehensive and equitable continuous training program for health workers is therefore imperative.

4.6.2 Training Issues Hospital Should Address

On training the respondents recommended development comprehensive and equitable continuous training programs and fair allocation of training opportunities regardless of professional cadre

4.7 Role of Promotion on Health Workers Retention

A significant percentage of respondents 46.2% disagreed that health staff promotions are regular with the employer. A significant percentage of 42.8% disagreed that what is stated in the promotion criteria is practiced always. Also 45.7% of the respondents
disagreed that promotions are based on merit. High percentage of 65.1% agreed that the promotion criteria over emphasizes on some cadres at the expense of others. These findings are in tandem with Ndetei, Khasakhala and Omolo (2008) who noted that lack of promotions makes workers jump ship and join the private sector, which is more rewarding or travel abroad. Health workers have gone on strike in different counties within the country due to delayed promotions.

Musyimi (2013) reported noted that there was concern that the Ministries of Health have retained non-performing officers due to a weak performance management system coupled with poor supervisory support. It was noted that Public Service Virtues like integrity, patriotism and other ethical values have not been mainstreamed in making appointments and promotion and hence the need to integrate them.

Table 4.8: Frequency and percentage distribution of promotion statements

<table>
<thead>
<tr>
<th>Promotion Statement</th>
<th>N (%)</th>
<th>Strongly Agree</th>
<th>agree</th>
<th>neutral</th>
<th>disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Health workers promotions are regular with my employer</td>
<td>10(3.7)</td>
<td>73(26.9)</td>
<td>63(23.2)</td>
<td>85(31.4)</td>
<td>40(14.8)</td>
<td></td>
</tr>
<tr>
<td>ii. There are good opportunities for promotion in my organization</td>
<td>10(3.7)</td>
<td>74(27.2)</td>
<td>82(30.1)</td>
<td>75(27.6)</td>
<td>31(11.4)</td>
<td></td>
</tr>
<tr>
<td>iii. Promotion are always based on merit in this organization</td>
<td>8(3.0)</td>
<td>58(21.6)</td>
<td>80(29.7)</td>
<td>84(31.2)</td>
<td>39(14.5)</td>
<td></td>
</tr>
<tr>
<td>iv. The promotion criteria in this organization over emphasizes some cadres than others</td>
<td>68(25.0)</td>
<td>109(40.1)</td>
<td>59(21.7)</td>
<td>25(9.2)</td>
<td>11(4.0)</td>
<td></td>
</tr>
<tr>
<td>v. Internal promotion is more regular in this organization compared to external recruitment</td>
<td>14(5.3)</td>
<td>86(32.3)</td>
<td>84(31.6)</td>
<td>80(18.8)</td>
<td>32(12.0)</td>
<td></td>
</tr>
<tr>
<td>vi. In my organization there is a clear promotion policy/criteria</td>
<td>17(6.3)</td>
<td>84(31.0)</td>
<td>72(26.6)</td>
<td>66(24.4)</td>
<td>32(11.8)</td>
<td></td>
</tr>
<tr>
<td>vii. What is stated in the promotion policy /criteria is what is practiced always</td>
<td>11(4.2)</td>
<td>50(18.9)</td>
<td>90(34.1)</td>
<td>68(25.8)</td>
<td>45(17.0)</td>
<td></td>
</tr>
<tr>
<td>viii. Promotions in this organization are rarely based on merit</td>
<td>30(11.3)</td>
<td>67(25.2)</td>
<td>81(30.5)</td>
<td>64(24.1)</td>
<td>24(9.0)</td>
<td></td>
</tr>
<tr>
<td>ix. I am satisfied with the promotion practices in this organization</td>
<td>5(1.9)</td>
<td>39(14.8)</td>
<td>94(35.7)</td>
<td>70(26.6)</td>
<td>55(20.9)</td>
<td></td>
</tr>
<tr>
<td>x. An employee upward career growth is important to this organization</td>
<td>69(25.9)</td>
<td>69(25.9)</td>
<td>78(29.3)</td>
<td>25(9.4)</td>
<td>25(9.4)</td>
<td></td>
</tr>
</tbody>
</table>

4.7.1 Perception on Whether Promotion Practices Increases Health Workers Retention

63% (n=165) of the participants agreed that promotion and promotional practices in the public sector increases health staff retention whereas 37.0% (n=97) disagreed. On their perception of the percentage increase resulting from promotion practices in the hospital, 35.2% (n=89) indicated 26-50%. A very high percentage 70.8% (n=172) indicated that lack of adequate promotion was one of the major reasons why health staff left their institutions for employment elsewhere.

4.7.2 Areas In Regard To Promotion Practices the Organization Should Improve

The respondents recommended timely promotions based on merit, consistent with promotion policy and finally increase budgetary allocations for promotions.

4.8 Role of Leadership Style on Health Workers Retention

From the results, most of the respondents 56.1% agreed that organizational leadership style makes positive contribution to overall effectiveness of the organization which includes enhancing employee retention. Majority of the respondents 40.7% disagreed that the leadership of the hospital listens to and addresses staff issues promptly. 48.5% agreed that the leaders communicates to staff regularly on matters important to them while 23.7% disagreed and 27.8% were neutral.

Table 4.9: Frequency and percentage distribution of leadership style statements

<table>
<thead>
<tr>
<th>Leadership Statement</th>
<th>N (%)</th>
<th>Strongly Agree</th>
<th>agree</th>
<th>Neutral</th>
<th>disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Organizational Leadership style in this</td>
<td>32(11.9)</td>
<td>119(44.2)</td>
<td>64(23.8)</td>
<td>38(14.1)</td>
<td>16(5.9)</td>
<td></td>
</tr>
</tbody>
</table>
organization makes positive contribution to the overall effectiveness of the organization

ii. My manager treats every one fairly

| Percentage | 36(13.5) | 94(35.3) | 67(25.2) | 46(17.3) | 23(8.6) |

iii. Leaders/supervisor assists individual health workers in their personal problems

| Percentage | 21(7.8) | 98(36.3) | 91(33.7) | 43(15.9) | 17(6.3) |

iv. Leadership/supervisor represents my needs, ideas and suggestions to his/her manager

| Percentage | 21(7.8) | 88(32.6) | 93(34.4) | 52(19.3) | 16(5.9) |

v. The leaders often involves staff in decision making, problem solving and policy making in the hospital

| Percentage | 20(7.4) | 90(33.1) | 69(25.4) | 63(23.2) | 30(11.0) |

vi. Leaders/supervisor rarely assists individual health workers in their personal problems

| Percentage | 27(10.1) | 64(24.0) | 96(36.0) | 63(23.6) | 17(6.4) |

vii. I have the opportunity to interact with management above my immediate supervisor

| Percentage | 27(10.0) | 105(38.9) | 49(18.1) | 45(16.7) | 44(16.3) |

viii. I am satisfied with the competence of the supervisors and Leadership in this organization

| Percentage | 26(9.6) | 89(32.8) | 77(28.4) | 56(20.7) | 23(8.5) |

ix. The leadership of this organization listens to and addresses staff issues promptly

| Percentage | 18(6.7) | 62(23.0) | 80(29.6) | 70(25.9) | 40(14.8) |

x. The leaders communicate to staff regularly on matters important to them

| Percentage | 29(10.7) | 102(37.8) | 75(27.8) | 42(15.6) | 22(8.1) |

xi. I am satisfied with the leadership style of the managers in this organization

| Percentage | 20(7.4) | 79(29.0) | 82(30.1) | 66(24.3) | 25(9.2) |

4.8.1 Perception on Whether Leadership Style Influences Health Workers Retention

Of the participants 49.8% (n=135) were of the opinion that leadership style did indeed influence health workers retention this percentage was almost equivalent, 50.2% (n=136) to that of those who disagreed. When asked about the percentage of retention occasioned by the leadership style, majority, 32.9% (n=85) respondents indicated 26-50%. About 29.8% (n=77) indicated 51-75%, 28.3% (n=73) indicated 1-25%, and only 8.9% (n=23) indicated 76-100%.

4.8.2 Leadership Style Commonly Practiced

When asked about the leadership style commonly practiced by the leaders in their hospital, 9.1% (n=23) indicated laissez faire and 37.8% (n=96) indicated authoritative style. However, majority of the respondents, 53.1% indicated that the leadership style commonly practiced by the leaders in the hospital was democratic (see Figure below). This explains why majority were satisfied with the leadership style of the directors.

![Leadership style chart](https://via.placeholder.com/150)

- Authoritative/Dictatorship
- Democratic/participative
- Laissez faire/Free reign

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4.8.3 Areas of Leadership Styles the Hospital Management Should Improve

The health workers would like to be more involved in decision making, channels of communication improved to enhance effective communication and finally improvement on supervision and management. Involve staff more in decision making.

4.9 Findings on Staff Retention

The measures of health workers retention are intention to stay and intention to leave. On average (58.3%) the respondents indicated that they planned to work at their present job as long as possible and a percentage of 39.9% indicated that they would hate to quit their current job. From table, a substantial percentage (25.5%) indicated that they were actively searching for an alternative and hence had intention to leave. However, on average (20.8%) indicated they were in their current institutions due to lack of alternative employment implying that they had intentions to leave only if opportunities were available.

Table 4.10: Frequency and percentage distribution of staff retention findings

<table>
<thead>
<tr>
<th>Intention to stay or leave</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>109(41.0)</td>
</tr>
<tr>
<td>Agree</td>
<td>54(20.3)</td>
</tr>
<tr>
<td>Neutral</td>
<td>28(10.5)</td>
</tr>
<tr>
<td>Disagree</td>
<td>28(10.9)</td>
</tr>
</tbody>
</table>

4.9.1 Perception of Rate of Health Staff Retention

When asked about their perception of the rate of health workers retention in their institution, 12.9% (n=33) rated retention in their institutions to be between 1-25%. Of respondents 30.1% (n=77) rated the staff retention in their institutions to be between 26-50%. 43.4% (n=111) rated it to between 51-75% and a minimal percentage of 13.7 % (n=35) rated it to be between 76 - 100%. This rating indicates that there were retention issues since in the absence of retention problem majority would have indicated 76-100% but this was not the case.

4.9.2 Overall effect of Remuneration, Training, Promotion and Leadership Style

When asked about their perception of overall effect of leadership style, remuneration, training and promotion on health workers retention, 12.3% rated the overall effect to be between 1-25%. 30.4% rated the overall effect to be between 26-50%, 44.7% indicated 51-75% and 12.6% indicated the overall effect of the independent variables on workers retention to be between 76-100%. This implies that respondents felt that the independent variables of the study had impact on health workers retention in their institution.

Table 4.11 Frequency and percentage distribution of overall effect of independent variables

<table>
<thead>
<tr>
<th>Statement</th>
<th>1-25%</th>
<th>26-50%</th>
<th>51-75%</th>
<th>76-100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall effect of leadership style, remuneration ,training and promotion</td>
<td>12.3% (n=31)</td>
<td>30.4% (n=77)</td>
<td>44.7% (n=113)</td>
<td>12.6% (n=32)</td>
</tr>
</tbody>
</table>

4.9.3 Positive Things about Working in Kenyatta National Hospital

Majority of KNH employees were very happy with the medical cover provided by the hospital: Unlimited medical cover for staff and their immediate families, extended for up to five years after retirement for the employee only. Staff received considerable salaries paid on time as compared to other government hospitals. Furthermore positions have competitive salary packages, according to level of qualification, as well as similar incentives to those offered by the Ministry of Health (Directorate of Personnel Management, 2005a, 2006; Kenyatta National Hospital). Respondents felt that they had job security this can be
attributed to the fact that majority of staff in KNH were permanent and pensionable employees see (Figure 4.7). Opportunities for furthering careers, on merit: local training, scholarships abroad and specialized training in specific branches of medical practice.

The hospital has enough resources and good infrastructure for treatment of basic diseases. However Kidney and cancer patients are the most affected by lack of adequate infrastructure, Statistics show that at least 1,300 cancer patients are on a two-year waiting list at KNH. Qualified and specialized professionals in all cadres so employees practice in their area of interest

4.9.4 Things You Do Not Like About Working for Kenyatta National Hospital

KNH has a weak referral system that results in congestion, high demand on resources, negative public image and poor quality of services. Focus group discussions revealed that patient nurse ratio did not meet WHO Standard with nurses being outnumbered. Contrary to what the national health-care referral system provides for, KNH receives many patients without any referral letters from institutions on Level 5 and below. Until September 2009, the Hospital did not maintain records on patients on referral from other institutions.

The hospital has high workload resulting from staff shortage and high number of patients. This often leads to staff working for long hours up to 16 hours during overnight shift as revealed in focus group discussions. For all health worker categories except medical officer interns and pharmacists, the number of in-post staff members does not reach the estimated needed staff members. Even though nurses already represent the largest share of health workers, their number has to be increased substantially (Ministries of medical services and public health and sanitation, HRIS and New Establishment).

Majority of the respondents felt that opportunities for professional growth in the hospital were not accorded on merit but rather discrimination, favoritism, nepotism and tribalism. This implies that in most cases policies put in place for the award of merit based, promotions and training were not adhered to. It is therefore not a surprise that majority of the respondents felt that there was lack or delay in promotions see (Table 4.9).

Although the hospital pays relatively higher basic salaries than the other government-owned hospitals nurses and technicians earn less than half the highest wage, which is earned by medical officers and specialists, dentists and radiologists. Medical officers earn the highest salary but this remains very low compared with international salaries, showing the poor competitiveness of Kenya on the international health labour market. In addition staff cited inadequate and delay of allowances.

Bureaucratic characteristics of inefficiency, long process of admitting and discharging patients, red tape, lack of flexibility, ineffective accountability and poor performance that be devilled delivery of health service. Poor coordination between ministries and policy makers has been identified as a key challenge that has held back the country’s budding health sector from realizing its potential. The hospital has adopted the devolved management style which underpins performance contracting where emphasis is management by outcomes rather than management by processes. Performance contracting was adopted as a results-based management system in 2003 and by 2005, most state corporations, including Kenyatta National Hospital (KNH), were put on performance contracting by the government of Kenya to counter this.

4.9.5 Rating of Importance of Independent Variables in Deciding to Leave

The respondents were asked to rank in order of importance the independent variables in their decision to leave. About 0.8% indicated that promotion would not be important at all; about 4.2% indicated that leadership style would be of little importance while 42.2% felt that it would be important, and 66.4% indicated that remuneration would be of critical importance in their decision to leave.

Table 4.12: Frequency and percentage distribution of independent variables in order of ranking

<table>
<thead>
<tr>
<th>Determinant</th>
<th>N (%)</th>
<th>Not important at all (%)</th>
<th>Little Importance (%)</th>
<th>Important (%)</th>
<th>Critically Important (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remuneration</td>
<td>1.1</td>
<td>1.5</td>
<td>30.9</td>
<td>66.4</td>
<td></td>
</tr>
<tr>
<td>Leadership style</td>
<td>1.5</td>
<td>4.2</td>
<td>50.2</td>
<td>44.2</td>
<td></td>
</tr>
<tr>
<td>Promotion</td>
<td>0.8</td>
<td>2.3</td>
<td>32.1</td>
<td>64.9</td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td>1.1</td>
<td>3.0</td>
<td>38.9</td>
<td>57.0</td>
<td></td>
</tr>
<tr>
<td>Work Environment</td>
<td>1.5</td>
<td>3.0</td>
<td>33.7</td>
<td>61.7</td>
<td></td>
</tr>
</tbody>
</table>

Generally almost all independent variables were rated highly as determinants on ones decision to leave since they all had ratings of more than 50% apart from leadership style which was rated at 44.2%. Wage penalties in the public sector increases turnover, while wage premiums reduce the chances of quitting. Specifically, a percentage increase in the gross wage gap (wage premium) in the civil service would result in a reduction in the probability of quitting of about 0.08 per cent. Similarly, a percentage increase in the basic wage gap (wage penalty) – equivalent to Ksh 71.50 – would lead to an increase in the probability of quitting civil service
of about 0.24 per cent for individuals residing in urban areas. Considering the general public sector, the positive wage difference (wage premium) is in favour of public sector, and hence the probability of quitting is very low (0.10%).

Nearly 45 per cent and 47 per cent of workers in public and private sectors, respectively, consider wage difference as one of the important factors motivating employees. The employees also note that non-monetary incentives play a critical role in motivating them to work. Some of the incentives include good working conditions, challenging assignments, flexible working conditions, job security and respectful positions. However, other factors undermine morale, including low salaries, lack of promotion or clear criteria for such, and poor working conditions (KIPPRA, 2015)

### 4.10 Inferential Analysis
#### 4.10.1 Bivariate Analysis

According to Mugenda and Mugenda (2003), correlation technique is used to analyze the degree of relationship between two variables. The computation of a correlation coefficient yields a statistic that ranges from -1 to +1. This statistic is called a correlation coefficient (r) which indicates the relationship between the two variables and the bigger the correlation the stronger the coefficient between the two variables being compared. The direction of the relationship is also important in that if it is positive (+) it means that there is a positive relationship between the two variables and this means that when one variable increases the other variable increases or when one variable decreases the other variable also decreases. A negative relationship (-) means that as one variable decreases the other variable increases and vice versa and hence an inverse relationship. If there is no relationship, the coefficient is equal to zero. Pearson’s Product moment correlation coefficient will be used to determine the strength and the direction of the relationship between dependent variable and the independent variables.

The researcher carried out correlation analysis between the variables of the study using Pearson correlation coefficient. Correlation Coefficient was used to test whether there existed interdependency between independent variables and also whether the independent variables were related to the dependent variable intention to leave. This section outlines the correlation analysis for data obtained in this study.

#### Table 4.12: Correlation Analysis between Health Workers Retention and Independent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson correlation</th>
<th>Intent to leave</th>
<th>Remuneration</th>
<th>Work environment</th>
<th>Training</th>
<th>Promotion</th>
<th>Leadership</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intent to leave</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>1</td>
<td>.325**</td>
<td>.089</td>
<td>.294**</td>
<td>.258**</td>
<td>.411**</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td><strong>&lt;0.001</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>257</td>
<td>198</td>
<td>216</td>
<td>237</td>
<td>245</td>
<td>247</td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.325**</td>
<td>1</td>
<td>.147**</td>
<td>.233**</td>
<td>.361**</td>
<td>.203**</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td><strong>&lt;0.001</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>198</td>
<td>206</td>
<td>183</td>
<td>199</td>
<td>196</td>
<td>199</td>
<td></td>
</tr>
<tr>
<td><strong>Remuneration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.089</td>
<td>.147**</td>
<td>1</td>
<td>.202**</td>
<td>.107</td>
<td>.242**</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>216</td>
<td>183</td>
<td>228</td>
<td>215</td>
<td>217</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td><strong>Work environment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.194</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.116</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>216</td>
<td>183</td>
<td>228</td>
<td>215</td>
<td>217</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.294**</td>
<td>.233**</td>
<td>.202**</td>
<td>1</td>
<td>.447**</td>
<td>.486**</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>237</td>
<td>199</td>
<td>215</td>
<td>250</td>
<td>238</td>
<td>241</td>
<td></td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.258**</td>
<td>.361**</td>
<td>.107</td>
<td>.447**</td>
<td>1</td>
<td>.383**</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>245</td>
<td>196</td>
<td>217</td>
<td>238</td>
<td>256</td>
<td>246</td>
<td></td>
</tr>
<tr>
<td><strong>Promotion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.411**</td>
<td>.203**</td>
<td>.242**</td>
<td>.486**</td>
<td>.383**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>247</td>
<td>199</td>
<td>220</td>
<td>241</td>
<td>246</td>
<td>260</td>
<td></td>
</tr>
</tbody>
</table>

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

*Correlation is significant at the 0.05 level (2-tailed).*

From the correlation matrix, all the independent variables were positively correlated (R>0). All the independent variables were significantly associated with intention to leave or stay except for work environment (p>0.838) meaning it did not influence decision to leave or stay at Kenyatta National Hospital. Positive correlation means that as remuneration, training, work environment, promotion and leadership practices were improved so did the likelihood of retention increase. Leadership style had
the highest significant relationship with intention to leave (P<0.01, R=0.411) followed by remuneration (P<0.01, R=0.325). In addition, to reduce intention to leave of the health workers, Kenyatta Hospital may require addressing all the independent variable especially address leadership style (R=0.411) issues more than remuneration (R=0.325), training (R=0.294) and promotion (R=0.258). When correlated among themselves, all were found to be positively associated except for work environment and promotion which had no significant association (P<0.116, R=0.107). Leadership style and training had the highest correlation among the variables (P<0.01, R=0.486). It is noted that there is a strong significant relationship between promotions and training (P<0.01, R=0.447) which is normally followed because additional training often leads to promotion.

These results imply that further statistical analysis can be carried out such as regression analysis. Further, the results indicate that while some of the factors may have higher influence on retention, a balance between all these factors is necessary for optimal retention of the health workers. The correlation results also rule out the problem of multicollinearity which arises in regression analysis in that none of the independent variables were highly correlated. A common rule of thumb is that correlations among the independent variables of between -0.70 and 0.70 do not have difficulties for regression analysis (Mason et al., 1999).

### 4.10.2 Multiple Regression Analysis

According to Mugenda and Mugenda (2003), although a correlation coefficient indicates the relationship between variables, it does not imply any causal relationship between variables and hence the need for further statistical analysis such as regression analysis to help establish specific nature of the relationships. Regression analysis determines the independent variables associated with a dependent variable and estimates the separate and distinct influence of each variable on the dependent variable. In this section, multiple regression analysis is presented for the data followed by the analysis of the results.

Multiple regression analysis explains or predicts variation in a dependent variable because of the independent variables and this is assessed using the coefficient of determination known as R square and the larger the coefficient, the larger the effect of the independent variable upon the dependent variable. The R Square can range from 0.000 to 1.000, with 1.000 showing a perfect fit that indicates that each point is on the line (Carver et al., 2009). The coefficients or beta weights for each variable allows the researcher to compare the relative importance of each independent variable. The null hypothesis for the test asserted that the independent variables have no influence on intention to leave of the health workers. In this study the unstandardized coefficients and standardized coefficients are given for the multiple regression equations.

The model is presented algebraically as follows:

\[
\text{Intention to leave} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon
\]

Where:

- **Y** is the dependent variable, health workers retention measured using intention to leave
- **X** is the independent variable for (i=1,2,...,5) (remuneration-X_1, work environment -X_2, training-X_3, promotion-X_4 and leadership style-X_5)
- **\beta_0** is the constant
- **\beta** is the coefficient of each of the independent variables for i= 1,2,3,4,5
- **\varepsilon** is the error term

The findings of the multiple regression analysis for this model on hospital basis are as follows:

Linear regression analysis was carried out using multiple regression models and the whole model was valid and significant, R square for the model was 0.244 representing 24.4% predicting power.

The equation of the fitted model using unstandardized coefficients is

\[
Y = 0.03 + 0.322 X_1 - 0.18 X_2 + 0.74 X_3 - 0.07 X_4 + 0.319 X_5
\]

Remuneration and leadership style were highly significant in determining health workers intention to leave Kenyatta National Hospital. This means that an increase of one unit of remuneration increases intention to stay by 0.322units. Likewise, an increase in one unit of leadership style increases health workers staying by 0.319 units. Work environment and promotion have a positive effect on intention to leave. However the relationship is not significant since (p value>0.01) therefore violating the rule of significance. The results indicate that one unit increase in either work environment or promotion will reduce employee’s intention to leave Kenyatta National Hospital by 0.18 and 0.07 respectively. Promotion has a positive impact on intention to stay though not significant.

### Table 4.13 Multiple Regression Analysis of All Variables

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>.030</td>
<td>.069</td>
<td></td>
<td>.430</td>
</tr>
<tr>
<td>Remuneration</td>
<td>.322</td>
<td>.078</td>
<td>.312</td>
<td>4.118</td>
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<td>Work environment</td>
<td>-.018</td>
<td>.077</td>
<td>-.017</td>
<td>-2.40</td>
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<tr>
<td>Training</td>
<td>.074</td>
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<td>.073</td>
<td>.853</td>
</tr>
<tr>
<td>Promotion</td>
<td>-.070</td>
<td>.083</td>
<td>-.070</td>
<td>-.847</td>
</tr>
</tbody>
</table>
5. Summary, Conclusions and Recommendations

5.1 Summary of Major Findings

5.1.1 Leadership Style on Retention of Health Workers

According to literature review, leaders and their leadership style can help promote an organization and make it attractive to employees or they can cause high turnover. This underscores the fact that leaders are critically important in staff retention. Therefore, the study sought to find out if the leadership style influences health workers retention in public health Sector in Kenya. Descriptive analysis showed that majority agreed that leadership contributes to the overall effectiveness of the organization which includes ability to retain staff. This supports the earlier argument that leaders have a pivotal role to play in staff retention. Minority of the respondents indicated that the leadership in their institution does not respond to staff issues promptly and a considerable percentage disagreed that staff were involved in decision making. Further a minority of the respondents disagreed that the leaders communicated regularly on matters important to them against majority who agreed that there was regular communication. In addition less than half of the respondents indicated that the leadership style commonly practiced in the hospital was authoritative. From the qualitative findings, other issues in regard to leadership included, lack of effective communication, weak supervision and involvement in decision making.

From the correlation analysis on hospital Leadership style had the highest significant relationship with intention to leave (P<0.001, R=0.411). In the general regression model analysis the results indicated that leadership style was negatively and significantly related to intention to leave. Remuneration and leadership style were highly significant in determining health workers intention to leave Kenyatta National Hospital. This means that an increase of one unit of remuneration increases intention to stay by 0.322 units. Likewise, an increase in one unit of leadership style increases health workers staying by 0.319 units.

Therefore, these findings show that the research which sought to establish the influence of leadership style on health workers retention was achieved because it established that leadership style influences health workers retention. It also established through qualitative data that, employees preferred leadership style that was more participatory and involves staff in decision making, regular supervision by superiors, practices regular communication, responds to staff matters promptly, is impartial always, as well as competent.

5.1.2: Remuneration on Health Workers Retention

Competitive and fair remuneration is indicative of the value the employers place on their employees. Also, pay may be one way employees can measure whether the time they spend and the effort they put in working are worthwhile. In public health Sector scenario, remuneration has been singled out as major issue and one that has often led to industrial action. Remuneration aspects include satisfaction with salary whether the salary is competitive and fair, whether it is comparable to similar organizations, or whether the institution provides salary supplements, financial incentives and whether these incentives are fairly awarded. Therefore, this study sought to establish whether remuneration influences health workers retention in public health sector in Kenya. The findings in the descriptive statistics showed that almost half of the respondents indicated that health workers salary was not adequate to meet their needs and a significant percentage of indicated that they were not satisfied with remuneration they received for their work. When compared with those with similar qualifications outside their organization a significant percentage indicated that they were not satisfied with their salary. Majority of the respondents indicated that they were not satisfied with their salaries when compared with those of their colleagues in their institution. A significant percentage disagreed that their hospital provide regular salary supplement in form of bonus and majority of the respondents were of the perception that bonuses were not allocated fairly. Majority had the perception that remuneration is one of the main reasons why health workers exited from Kenyan National Hospital.

Remuneration is a critical factor of motivation and retention. Although positions in the hospital have competitive salary packages, according to level of qualification, a higher proportion of health staff felt their remuneration was not fair. However, it was noted that financial incentives should be integrated with other incentives, particularly with regard to migration where it was concluded that financial incentives alone would not keep health workers from migrating and that improving working and living conditions may be more effective than increasing wages to reduce migration flows. Nevertheless, low salaries were found to be particularly de-motivating as health workers felt that their skills were not valued.

Furthermore, they became overworked working long hours without compensation for hours worked overtime. Family health care, salary, allowances and terminal benefits are important compensation factors that are closely linked to retention. Health workers place emphasis on family care; compensation is highly regarded if it has direct benefit to dependents. Family health care was even rated higher than salary among respondents. Majority of health workers in this study were in their mid-years and married with children. Compensation to workers with families transcends individual interests and, therefore, policies on recruitment and compensation should include benefits for dependents.
5.1.3 Training on Retention of Health Workers

Education and training opportunities have strong motivating effects. Training enables workers to take on more demanding duties and to achieve personal goals of professional advancement as well as allow them to cope better with the requirements of their job and was found to be especially important for young health professionals. Training is important to the organization as well as to the individual employees. Many of the world’s best successful organizations are aware that the provisions they make for training and development activities lie at the heart of their ability to attract and retain the best employees in their organization. From the employee perspective, training makes employees feel recognized for their strengths and also creates possibilities for developing their careers. Aspects related to training include availability of training opportunities, satisfaction with the training offered by the organization, application of the training policy, comparison of training opportunities with other organizations and satisfaction with training practices. This study sought to find out whether training influences retention of health workers in the public health sector in Kenya. From the descriptive analysis, majority agreed that the skills and knowledge learnt on the job would transfer easily to other similar organizations indicating that the health workers felt that they could easily fit in other similar organizations. On average, the respondents disagreed that there is fairness in the implementation of the training policy. Also on average, the respondents disagreed that the financial support is regularly given to attend conferences and workshops to enhance professional development for the health workers. However a significant percentage agreed that they were satisfied with the training practices in their institution. Majority of the respondents agreed that training offered in the hospital increased Health Workers retention.

From the qualitative analysis the respondents recommended development of a comprehensive and equitable continuous training programs and Fair allocation of training opportunities regardless of professional cadre. Majority agreed that the hospital has more training opportunities than similar organizations. The hospital has fully fledged training department which supports post graduate training of health workers and other professionals.

Leadership style and training had the highest correlation among the variables In the correlation analysis, training had a significant and positive relationship with intention to leave. In the general multiple regression analysis, the relationship between intention to leave and training was not significant. This means that, in the presence of leadership style, remuneration and promotion, training does not influence intention to leave of health workers and hence it is not a determinant of health workers retention. These findings therefore show that the study which sought to establish the influence of training on health workers retention was achieved because training in the presence of leadership and remuneration was not a significant predictor in the general analysis for Kenyatta National Hospital and hence not a determinant of intention to leave.

5.1.4 Promotion on Retention of health workers

Promotion is viewed as desirable by employees because of the impact it has on pay, authority, responsibility and the ability to influence broader organizational decision making. For the health workers upward mobility is highly desirable since majority are career oriented. The main aspects of promotion in public health sector include availability of promotion policy, whether promotions are regular, whether there are good promotional opportunities, whether promotion criteria/policy is balanced or skewed towards certain duties, whether promotion is based on merit, and whether internal promotions are considered before external appointments. Therefore, the study sought to find out whether promotion influences health staff retention in Kenyan public sector. From the descriptive analysis, it was established that on average the respondents disagreed that promotions are based on merit. On average, the respondents indicated that they were not satisfied with the promotion practices in the hospital.

A high percentage indicated that lack of adequate promotion was the main reason that contributed to health workers leaving. From the qualitative analysis, majority of those who had left cited lack of promotion as the major factor that influenced them to leave. The aspects related to promotions that were unfavorable included lack of consistency in the application of the promotion criteria and partiality.

Correlation analysis showed that promotion was significantly and negatively related to intention to leave. Therefore promotion had a negative and significant relationship with intention to leave in the hospital and this means that increase in the favorable aspects related to promotion would decrease intention to leave and hence enhance retention of the health staff. When correlated with the other independent variables the results indicated strong positive relationship. Promotion was positively and significantly related to leadership style, with remuneration and with training. The general correlation analysis established that promotion had a negative significant relationship with intention to leave. This indicates that the more promotion practices are favorable, the less the intention to leave among the health workers in the hospital.

Therefore, these findings show that the research which sought to establish the influence of promotion on health workers retention in Kenyatta national Hospital was achieved because it established that promotion influenced intention to leave and conversely influenced retention of the health workers. It also established through qualitative data that the health workers preferred consistent promotion criteria and practices, universal application of the criteria to all staff, regular internal promotions, and all inclusive promotion criteria.

5.1.5 Work Environment on retention of health workers
The main aspects of work environment in public health sector include job security, workload, availability of equipment and supplies required to perform the job and social amenities, access to utilities both at work and place of residence. A significant majority felt that they have job security. Less than half of the respondents felt that they have the equipment to do the job well and safely. Majority of the respondents felt that the workload is not manageable.

From the qualitative analysis, majority of the respondents felt that the workload is not manageable especially among the clinical staff who work in shifts and required to work long hours especially during night shifts. The hospital should ensure that only referral patients are admitted for treatment in order to attain a favorable patient health worker ratio at the hospital seeing that Kenyatta National Hospital is ideally a referral hospital. On correction analysis work environment was not significantly with intention to stay or leave but was positively correlated with all the other variables. Work environment has a negative effect on intention to leave. However the relationship is not significant since (p value>0.01) therefore violating the rule of significance. The results indicate that one unit increase in work environment reduces employee’s intention to leave Kenyatta National Hospital by 0.18.

Therefore, these findings show that the research which sought to establish the influence work environment on health workers retention in Kenyatta national Hospital was achieved because it established that work environment influenced intention to leave and conversely influenced retention of the health workers. It also established through qualitative data that the health workers preferred manageable workload and access to supplies and equipment to enable them do their job efficiently. Access to social amenities is important for health workers.

5.2 Conclusion

Based on the findings of this study, this research concluded that leadership style influences health workers’ retention in Kenyan National Hospital. There was an inverse relationship between leadership style and intention to leave. Intention to leave is the measure commonly used in studies to assess staff turnover and retention. When leadership style is unfavorable intention to leave increases and when it is favorable intention to leave decreases, hence enhancing staff retention. Further, this study established that leadership style had more predicting strength than the other independent variables. This aligns to the argument that employee leave leaders and not organizations. This study also concluded that the leadership practiced by most of the leaders in KNH was favorable for retention since from the findings majority indicated that democratic leadership style was commonly practiced. Further the study concluded that health staffs were not adequately involved in decision making and regular communication was lacking. Similarly, the study also concluded that staff issues were not addressed promptly.

Based on the findings, the study concluded that remuneration for the health workers did influence their retention. The public health sector has been experiencing industrial action related to remuneration. There is a significant relationship between remuneration and intention to leave that came out in the correlation analysis. Remuneration was a predictor of intent to stay in multiple regression analysis. There is no harmony in the compensation of health workers in the organization. Although health workers felt their salaries compared well with employees in other organizations with similar qualifications, this is not the case when they compare internally.

The findings led to the conclusion that training offered to the health workers did influence their retention. Staff training was a predictor of intention to leave or stay. The respondents agreed that training opportunities were available to study both locally and abroad. Health workers values opportunities for professional development. This is in line with other studies that concluded that health workers shy away from rural postings as the opportunities for trainings are limited. Further, the findings indicated aspects of training practices and policy that were unfavorable such as partiality in the implementation of the training policy the hospital needs to seriously address. The training need analysis was done at departmental level.

Based on the findings, the study concluded that promotion influences health workers retention in Kenyatta National Hospital. There was an inverse relationship between promotion and intention to leave implying that the more promotion was perceived to be unfavorable, intention to leave increased and vice versa. The promotion and promotional practices in these institutions were not favorable for staff retention. The researcher concluded that the promotion criteria or practices were not fairly applied and there were inconsistencies with the criteria.

Based on the findings a significant majority was satisfied with the work environment in terms of job security, access to supplies and equipment, social amenities both inside and outside the Hospital. However the issue of workload manageability is a source of significant stress as results to burn out among the health workers. Work environment was not a predictor of intention to stay therefore did not influence retention.

5.3 Recommendations

5.3.1 Policy Recommendations

A policy and practical area that this research can be applied is in remuneration. Whereas it is clear that the hospital may not have control over health workers salaries, the hospital can improve on non-monetary incentives like recognitions. The allowances the
hospital has control over should be distributed in a manner that is fair to all cadres of staff. Job evaluations should be carried out in order to enhance salary harmonization.

The field of medicine is ever changing and therefore the hospital should continue supporting the staff to attend to both local and external trainings to develop their competencies. Family support programs should be implemented as majority of the work force are married and health professionals are at their peak when they already have families.

Both promotion and training policies should be adhered to in order to create a sense of organizational justice among the health workers. The criteria should outline clearly the stand of the institution on internal promotions versus the external appointments. The criteria/policy should be revised to make it all inclusive so that it is not skewed in favor of some duties while ignoring others and also to reflect fairness. The bureaucratic procedures surrounding the promotion process should be revised to avoid unnecessary delays.

5.3.2 Recommendations for the Management of Kenyatta National Hospital

Being a public hospital, the management may not make unilateral decisions regarding remuneration, and promotion which have a cost implication but they have control over training, work environment and leadership. The staff at Kenyatta National Hospital value democratic style of leadership, involvement in decision making and regular communication on matters affecting them. The management can do with little or no cost implications. Job design and rotation will also enhance proficiency of the health workers

The cost of training a health professional to acquire the skills and competencies desired is expensive both to an individual and the country. The explicit knowledge can be replaced but the tacit knowledge which the worker has acquired over time cannot be replaced consequently, the management should make retention of staff a priority to guarantee quality services and products. To do so, they need to embrace the modern retention trends such as employer branding and having compelling value proposition in order to become the employer of choice.

The study shows that employees remain in organizations due to a mixture of both intrinsic and extrinsic factors. The management of these institutions should develop retention policies and strategies that capture both dimensions and constantly review them for effectiveness because employees’ needs and expectations are dynamic. This study brought to the fore the critical role of leadership and leadership style in retention of health workers. It is recommended that the leadership in these institutions should embrace favorable leadership practices to enhance retention of health workers since leaders have an influence on plethora of organizational factors which affect retention.

5.3.3 Areas for Further Research

A review of literature indicated that there has been limited amount of research on health workers retention in the Kenyan context. Thus, the findings of this study serve as a basis for future studies on retention and on this population. Most studies have focused on retention of nurses and retention of health workers in rural settings. Health workers research has been limited to doctors and nurses yet they are so many categories of health workers who are crucial in service delivery.

This study confined itself to the Kenyatta National Hospital. A cross sectional survey can be done in the public hospitals in Kenya especially now that the health function has been devolved. The independent variables may be the same but their level of influence is different for rural hospitals. KNH being a referral hospital may have challenges which are not there in rural hospitals.

Further research can be done regarding professional retention versus organizational retention. The cost of training health professionals is high and it would be interesting to research on factors influencing professional retention or change of profession among health workers and longitudinal survey to compare the categories of different health workers especially clinical staff. This may be a comparative study among the clinical staff.

REFERENCES


Christina M. Stello. (n.d.). An Integrative Literature Review. Herzberg’s Two-Factor Theory of Job Satisfaction, 32.


Culture, O. O. (n.d.). Employee Job Satisfaction and Engagement Optimizing Organizational Culture for Success Employee Job Satisfaction and Engagement Optimizing Organizational Culture for Success.


(Ministry of Medical Services). (2012). *National Human Resources for Health*.


STRATEGIC FACTORS AFFECTING GROWTH OF MICRO, SMALL AND MEDIUM ENTERPRISES IN KENYA: A SURVEY OF SMES IN BOMET CENTRAL BUSINESS DISTRICT, BOMET COUNTY

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Abstract: Despite the vital role of SMEs in building a competitive private sector and contributing significantly to economic growth and job creation, SMEs are facing more challenges around the world in general and in developing countries in particular. The main objective of this study was to assess the strategic factors affecting growth of micro, small and medium enterprises in Bomet County. Data was collected using both open and closed ended questionnaires. In order to realize this purpose, this study adopted descriptive research employing the use of questionnaires, observation and interviews to collect data from a sample size of 52 SMEs in Bomet Central Business District which were selected using stratified random sampling. Data was subjected to coding for easier analysis. Data was then analyzed using descriptive statistics such as percentages, frequencies, figures and tables. The study found out that technology, access to finances, innovation and having a strategic plan all affect the growth of SMEs. It further established that investing in technology made business activities efficient and ability to fit in the dynamic business world where technology is evolving day and night, access to finances was also noted to be paramount in any business venture for restocking, salaries and wages and carrying out research and development, innovation was also viewed to put any business entity on the competitive edge as it was observed that those who engaged in innovation were seen to be doing better than those who did not engage in innovation, having a strategic plan also gave direction in running the business and aids in allocation of resources and persons responsible in executing the laid down tasks in order to meet the organizational objectives.

Key Words: Micro-small and medium enterprises, Entrepreneur, Innovation, Strategic planning

1. INTRODUCTION

Entrepreneurship all over the world is emerging today as an avenue for gainful employment, a means of helping entrepreneurs to assert themselves in the world of work, and a way of improving both their economic and social status. Small and Medium Enterprises (SMEs) are viewed as a key driver of economic and social development in the African context. They represent a large number of businesses in a country, generate much wealth and employment and are widely considered to be vital to a country’s competitiveness. SMEs are hailed for their key role in promoting grassroots economic growth and equitable sustainable development (Pelham, 2000). Small- and medium-sized enterprises (SMEs) are considered engines of growth in developing countries. In developed countries, SMEs have historically played a vital role in creating jobs, spurring innovations, and creating new products, and thus contributed to economic vitality and growth. Taking these experiences into account, African countries should not overlook the importance of promoting SMEs in the same regard. However, considering the situation of most African countries, there are several impediments that have to be removed in order for SMEs to flourish. Recently, the strong presence of Asian SMEs in Africa and increasing competition has negatively affected local SMEs (Hallberg, 1999).

Small and medium enterprises in Kenya’s manufacturing sector are defined as enterprises with fulltime employees not exceeding 100 or annual sales turnover not exceeding Ksh 150 million. The development of competitive and resilient small and medium enterprises (SMEs) forms an integral component of Kenya’s initiatives to be globally competitive and prosperous nation with a high quality of life by 2030 (GoK, 2007). The challenges posed by increased liberalization, new entrants to the market, increased standards requirements and technological developments require SMEs to raise efficiency levels, strengthen inter-firm linkages and respond timely to market changes. At the same time, greater integration into the global economy provides opportunities for SMEs to participate in the international value chain and supply chain networks. This will enable SMEs to move up the value chain and adopt new technologies,
particularly information and communication technology (ICT). Only SMEs that are capable of harnessing technology and knowledge to develop high value-added products of superior quality will be able to compete globally (GoK, 2007).

The Micro and Small Enterprise (MSE) has been identified as the leading employment sector in the country employing over 11.8 million people. According to a report by a special committee working on the modalities of de-linking the Micro and Small Enterprise Authority (MSEA) from the Ministry of Industrialization, the sector contributes to over 80% employment in the country.

Small and medium enterprises are major contributors of employment creation and economic growth globally. It is observed that the health of the economy as a whole has a strong relationship with the health, nature and performance of the SMEs sector. For instance when the state of the macro economy is less favorable the opportunities for profitable employment expansion in SMEs are minimal. The significant role of small business in the Kenyan economy suggests that an understanding of their performance is crucial to the stability and health of the economy (Kioko, 2015).

Whereas starting and operating a small business includes a possibility of success as well as failure there is general consensus that smallness and newness cause immense difficulties for businesses. In Kenya today, over sixty percent of small businesses are estimated to fail annually. Judging by the performance of the informal sector in Kenya, not much progress seems to have been achieved despite numerous government efforts to promote SMEs activity. Due to their exposure to risks owing to their location and small size, a simple management mistake is likely to lead to sure death and closure of a small enterprise hence no opportunity to learn from its previous mistakes. Hence, not many SMEs grow to significantly contribute to employment creation and economic growth. Unfortunately, there is very little information on how the small business sector is managed, regulated and structured (Kioko, 2015).

Despite the vital role of SMEs in building a competitive private sector and contributing significantly to economic growth and job creation, SMEs are facing more challenges around the world in general and in developing countries in particular. Likewise, Kenyan SMEs face numerous and serious challenges to their growth for instance the cumbersome legal and regulatory constraints, lack of access to external financing, low human resources capacities, lack of management skills and training, and low technological capacities, lack of innovation amongst other challenges.

The numerous challenges posed by new market entrants, increased liberalization, increased standards requirements and technological advancements require SMEs to raise their efficiency levels, strengthen inter-firm linkages and respond timely to market dynamics in the business environment. Additionally, greater integration into the global economy provides opportunities for SMEs to actively participate in the supply chain networks and international value chain. This will enable SMEs to move up the value chain and utilize new and useful technologies, particularly information and communication technology (ICT). Only SMEs that are capable of taking advantage of emerging technology and knowledge to develop value-added products of high quality will be able to compete with other firms globally.

The general objective of this study was to examine the strategic factors affecting growth of Small and Medium Enterprises in Bomet Central Business District, Bomet County. The specific objectives were: to determine how technology affect growth of Small and Medium Enterprises in Bomet Central Business District, Bomet County, to determine how access to financing affects growth of Small and Medium Enterprises in Bomet Central Business District, Bomet County, to establish how innovation affects growth of Small and Medium Enterprises in Bomet Central Business District, Bomet County and to establish how strategic planning influence the growth of SMEs in Bomet Central Business District, Bomet County.

The research focused on 52 registered SMEs in manufacturing sector of Bomet Central Business District in Bomet County. The SMEs included enterprises engaged in tailoring, furniture making, boutiques, electronics dealers, vegetables and fruits vendors, bakeries and others in Bomet town because most of the SMEs in the area engage in these activities. The study participants were the owners and employees of the SMEs.

2. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 The Balanced Scorecard (BSC)

BSC suggests managers to view organization’s performance from four dimensions, customer perspective, internal perspective, innovation & learning perspective, financial perspective (Kaplan & Norton 1996). BSC incorporates financial and non-financial measures in one measurement system. The objectives and measures of BSC are derived from an organization’s vision and strategy. The Balanced Scorecard provides executives with a comprehensive framework that translates a company’s vision and strategy into a coherent set of performance measures.

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According to Kaplan & Norton (1996) the balanced scorecard not only allows the monitoring of present performance, but also tries to capture information about how well the organization is positioned to perform in the future. Furthermore, the Balanced Scorecard has evolved to become a core management tool, in that it helps CEOs not only to clarify and communicate strategy, but also to manage strategy. In practice, companies use the BSC approach to accomplish four critical management processes, clarify and translate vision and strategy, communicate and link strategic objectives and measures, plan, set targets, and align strategic initiatives and enhance strategic feedback and learning.

2.1.2 Pecking Order Theory
In the theory of firm's capital structure and financing decisions, the Pecking Order Theory or Pecking Order Model was first suggested by Donaldson (1961) and it was modified by Myers and Majluf (1984). It states that companies prioritize their sources of financing (from internal financing to equity) according to the Principle of least effort, or of least resistance, preferring to raise equity as a financing means of last resort. Hence, internal funds are used first, and when that is depleted, debt is issued, and when it is not sensible to issue any more debt, equity is issued.

Pecking Order Theory starts with asymmetric information as managers know more about their company’s prospects, risks and value than outside investors. Asymmetric information affects the choice between internal and external financing and between the issue of debt or equity. There therefore exists a pecking order for the financing of new projects. Asymmetric information favours the issue of debt over equity as the issue of debt signals the board’s confidence that an investment is profitable and that the current stock price is under-valued (if stock price was over-values the issue of equity would be favoured). The issue of equity would signal a lack of confidence in the board and that they feel the share price is overvalued. An issue of equity would therefore lead to a drop in share price. This does not however apply to high-tech industries where the issue of equity is preferable due to the high cost of debt issue as assets are intangible. Tests of the Pecking Order Theory have not been able to show that it is of first-order importance in determining a firm's capital structure.

2.1.3 Schumpeter Theory
Schumpeter, as cited by Swedberg (2000), pointed out economic behavior is somewhat automatic in nature and more likely to be standardized, while entrepreneurship consists of doing new things in a new manner, innovation being an essential value. As economics focused on the external influences over organizations, he believed that change could occur from the inside, and then go through a form of business cycle to really generate economic change.

Swedberg (2000) set up a new production function where the entrepreneur is seen as making new combinations of already existing materials and forces, in terms of innovation; such as the introduction of a new product, introduction of a new method of production, opening of a new market, conquest of a new source of production input, and a new organization of an industry (Casson, 2002). For Schumpeter, the entrepreneur is motivated by the desire for power and independence, the will to succeed, and the satisfaction of getting things done. Swedberg (2000) conceptualized ‘creative destruction’ as a process of transformation that accompanies innovation where there is an incessant destruction of old ways of doing things substituted by creative new ways, which lead to constant innovation.

2.1.4 Technology Acceptance Model (TAM)
Davis (1989) presented a theoretical model aiming to predict and explain ICT usage behavior, that is, what causes potential adopters to accept or reject the use of information technology. Theoretically, TAM is based on the Theory of Reasoned Action (TRA). In TAM, two theoretical constructs, perceived usefulness and perceived ease of use, are the fundamental determinants of system use, and 15 predict attitudes toward the use of the system, that is, the user’s willingness to use the system. Perceived usefulness refers to “the degree to which a person believes that using a particular system would enhance his or her job performance”, and perceived ease of use refers to “the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989).

In these articles TAM was used in three different ways, namely to compare different adoption models, develop extensions of TAM, or replicate the model. For example, Davis et al. (1989) empirically compared the ability of TRA and TAM to predict and explain the acceptance and rejection by users of the voluntary usage of computer-based technology; Venkatesh and Davis (2000) developed and tested a theoretical extension of TAM, referred to as TAM2, which explains perceived usefulness and usage intentions with the help of social influence and cognitive instrumental processes, and Adams et al. (2002) replicated Davis’ (1989) study.

2.2 Empirical Literature
A number of studies have been conducted on microfinance and SMEs in Kenya. For instance, China Microfinance Industry Assessment Report provided by the China Association of Microfinance gives the definition of microfinance in China, and examines the impacts of microfinance development at macro, and micro levels, spanning over agricultural industry, financial markets, and social vulnerable groups such as women and farmers (He, Du, Bai & Li, 2009).
Many studies then have focused on each level specifically. Li (2006) concludes that microfinance has offered an effective finance method for the construction of new socialist rural regions and has won the support of agriculture and farmers. Dyar, Harduar, Koenig, and Reyes (2006) together examined the impact of microfinance on gender inequality in China and discovered that there are many benefits to providing microfinance to women, despite lack of conclusive evidence on significantly reducing gender inequality. Microfinance allows women to enjoy greater economic power, better living quality, and stronger social and political empowerment.

Park, Ren, and Wang, (2004) assess the potential role of microfinance for financial reform in China and suggest that China’s financial reforms have yet to create an institutional space in which microfinance can operate, thrive, and expand. Therefore, expansion of microfinance will almost definitely have to await substantial further progress in creating a well-developed commercial, financial system. In the meantime, however, microfinance programs are competing with China’s official financial institutions and levying pressure on the practice and reform of the rigid state-owned financial institutions.

In addition to research on reform, studies have also been conducted on the structure of microfinance. Sun (2008) studies the policy and legal framework for microfinance and suggests that governments will have to continue to focus on improving the legal and political environment for microfinance if the industry is to continue to grow and prosper. Park and Ren (2001) study the nongovernmental and governmental microfinance programs from cultural perspective and find that nongovernmental programs perform well in aspects of reaching the poor (targeting), guiding financial and operational performance (sustainability), and establishing program benefits (impact). Meanwhile, Tsai (2004) points out four reasons for the existence of informal microfinance: the limited supply of formal credit; limits in state capacity to implement its policies; the political and economic segmentation of local markets, and the institutional weakness of many microfinance programs.

To study the development of SMEs, Chen (2006) gives an overview of the historical development and current status of SMEs worldwide and examines major political initiatives contributing to the development of SMEs. Liu and Yu (2008) look into the structure of Africa’s financial system and argue that insufficient development of rural SMEs and regional divergence in SME development are important causes of urban-rural income inequality. Shen, Shen, Xu, and Bai (2009) further examine how bank size, discretion regarding credit, incentive schemes, industrial competition, and institutional environment could affect lending.

Previous studies have also shown that a number of factors hamper the growth of small businesses, including lack of capital or financial resources, however, the degree to which limited financial resources alone are a major obstacle to business development is still controversial. For example, findings show that additional capital is often not required to carry out a successful business activity and that lack of capital can be compensated through creativity and initiative (Hart, 1972; Harper and Soon, 1979; Godsell, 1991; Dia, 1996). In addition, Kallon (1990) found that the amount of capital needed to start a business is significantly negative when related to the rate of growth for the business. He also found that access to commercial credit did not contribute to entrepreneurial success in any significant way, and if it did, the relationship would be negative.

On the other hand, some researchers have argued that small businesses are under-capitalized. Many entrepreneurs tend to depend upon their own or their family’s savings to start and operate a business; this means of capitalization is limited. Thus, access to capital remains a challenge. For example, Kallon (1990) found that 65.6 percent of the firms studied depended upon personal savings as their sole source of capital, 10.9 percent had access to family savings, 9.4 percent used commercial banks, and 7.8 percent drew resources from partners and shareholders and other sources. Keyser et al. (2000) found that in Zambia, a lack of starting capital was a common problem for entrepreneurs, as only 24 percent of entrepreneurs received a loan to start their business.

Another study by Koop et al. (2000) found that the amount of starting capital was positively related to business success. Research on the role of capital in determining the success or failure of small businesses in Africa is contradictory and, therefore, remains unclear. Overall, most small businesses cannot meet the requirements for commercial loans because they lack collateral, and those who meet the requirements still find them prohibitively expensive in terms of repayment.

Management problems, including accounting, finance, personnel, and management issues, have been cited as a major cause of business failure for small businesses. The findings of a study by Tushabomwe-Kazooba (2006) revealed that poor recordkeeping and a lack of basic business management skills are major contributors to small business failure in Africa. The lack of management experience often makes it difficult for business owners to succeed. Researchers have also identified other factors hindering the success of small businesses, such as poor bookkeeping, inexperience in the field of business and the lack of technical knowledge, poor managerial skills, lack of planning, and lack of market research (Lussier, 1996; Mahadea, 1996; Murphy, 1996).

Other acknowledged factors which negatively affect small business development include corruption, poor infrastructure, poor location, failure to conduct basic market research, and the economy (Kazooba, 2006; Mambula, 2002). For example, Kiggundu (2002) argued that the major challenges that face African businesses include, bribery, dishonest, and other illegal business conducts. These activities have hampered business entrepreneurial in sub-Saharan Africa in general and Kenya in particular. These unethical activities
enable those in positions of power, control, and influence to make fast and illegal money. In general, corruption affects people in different occupations, including small businesses.

In addition to undermining the legal framework, national integrity, and regulatory system, it also undermines the trust and confidence of business owners (Langseth & Stapenhurst, 1977; Pop, 2002). Practically every African country has its own version of corruption at a great cost to entrepreneurs, the economy, public administration, and society at large. However, the impact of corruption on small business development still remains unclear from prior research. An understanding of the specific impact of corruption on small business development is, therefore, crucial in terms of developing strategies to address the issue.

The studies cited in this brief review have indicated that issues such as lack of finance, poor management, corruption, lack of infrastructure, and poor accounting/bookkeeping are major obstacles to small business development in Africa. However, it is important to point out that there are other factors that impact small business development in Africa that must be investigated. Such factors include low demand for products and services, and inability to use or acquire technology. One of the major contributions of small business ownership is that it allows people, especially the poor, to enter the economic and social mainstream of society (Harris & Gibson, 2006).

2.3 Research Gaps and Critique of Existing Literature

The literature reviewed included the balanced score card, technology acceptance model, the pecking order theory and the Schumpeter theory. These theories adequately explain the strategic factors influencing SME growth in the developed world since the supporting data collected and analyzed was from different areas in the United States of America and the United Kingdom. It is therefore clear that all these studies were conducted in countries outside the African continent and as such do not sufficiently capture the unique social, political and economic concerns that growing entrepreneurs have to encounter each day to ensure growth and sustainability of their ventures. Therefore, in this study we shall focus on strategic factors affecting growth of SMEs in the Central Business District of Bomet County, Kenya so that we are able to understand what needs to be done differently in order to ensure success of this sector.

Finance aspect is important in any business and most of the reviewed studies do talk about it. But it is notable that finance alone cannot make entrepreneurs successful. It must be in uniformity with the person’s will to succeed in business and the training in the field in which the enterprise is set. The literature on factors influencing growth of SMEs has majorly focused on specific SMEs sectors like manufacturing which may not portray the image in general for all the sectors of SMEs across. Walobwa (2013) looked at the effect of innovation on the growth of SMEs in Kenya focusing on garment enterprises only in Jericho market. He found out that innovation is very critical for SMEs to become and remain competitive in the global market. Since it only focused on garment industries this leaves room for more research across SME sectors in order to bring out more findings.

Most of the methodologies adopted by researchers in the past studies have been focusing on innovative and non-innovative SMEs hence very difficult to distinguish between the two groups since a firm may be termed non innovative when it is really innovative. The existing literature has concentrated more on other general factors other than the ones in this study like a study by Nyagah (2013) which focused on non-financial constraints hindering growth of SMEs in Kenya. The factors in his study were business location, advertising, market competition among others and how they influence SME growth as measured by income and therefore not exhausting the entrepreneurial factors in details. The models that have been adopted by other researchers have been general in nature not focusing on specific parameters of growth as is the case in this study where focus is on growth as measured by sales revenue, customer increase and market expansion.

At the same time some of the past studies ignore the aspect of government as a regulator of the SME business environment and the fact that enterprises do not gain their full potential when they do not comply with set laws and regulations. This makes them target to harassment and exploitation by law enforcers which in the long term is expensive, disrupts business and affects its performance. SMEs continue to be hailed as a huge employer in the Kenyan economy. However, the entrepreneurs still continue to languish in poverty since most of them do the businesses for their survival. Many SMEs though operational stagnate at one stage for many years, performing dismally and employing only the owner. This means that such SMEs die when the owners die. No legacy and perpetuity is expected when performance in these SMEs is negligible.

3. METHODOLOGY

This study adopted a descriptive design because the study sought to answer the why, how and when of the problem under study. According to Mugenda and Mugenda (2003), a descriptive research design is flexible and it provides an opportunity to examine all aspects of a problem and it will capture all the characteristics of the target population.

Descriptive research involves field survey where the researcher goes to the population of interest to ask certain issues about the problem under the study. According to Owens (2002), survey research design has the advantage of uniqueness since information
gathered is not available from other sources, having unbiased representation of population of interest and standardization of measurement as same information is collected from every respondent.

The target population comprised of business owners, supervisors and other members of staff. This is shown in 3.1 below:

**Table 3.1: Target population**

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tailoring</td>
<td>20</td>
</tr>
<tr>
<td>Furniture Making</td>
<td>30</td>
</tr>
<tr>
<td>Boutiques</td>
<td>80</td>
</tr>
<tr>
<td>Electronics Dealers</td>
<td>60</td>
</tr>
<tr>
<td>Vegetable and Fruit Vendors</td>
<td>50</td>
</tr>
<tr>
<td>Bakeries</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>260</strong></td>
</tr>
</tbody>
</table>

Since the researcher used survey design, stratified sampling technique was employed. Stratified sampling is a probability sampling technique where the researcher divides the entire population into different subgroups or strata, then randomly selects the final subjects proportionally from the different strata.

A sample size of 52 SMEs in Bomet Central Business District, Bomet County was used for the purpose of this study.

**Table 3.2: Sample size**

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Sample Proportion</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tailoring</td>
<td>20</td>
<td>20%</td>
<td>4</td>
</tr>
<tr>
<td>Furniture Making</td>
<td>30</td>
<td>20%</td>
<td>6</td>
</tr>
<tr>
<td>Boutiques</td>
<td>80</td>
<td>20%</td>
<td>16</td>
</tr>
<tr>
<td>Electronics Dealers</td>
<td>60</td>
<td>20%</td>
<td>12</td>
</tr>
<tr>
<td>Vegetable and Fruit Vendors</td>
<td>50</td>
<td>20%</td>
<td>10</td>
</tr>
<tr>
<td>Bakeries</td>
<td>20</td>
<td>20%</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>260</strong></td>
<td><strong>100%</strong></td>
<td><strong>52</strong></td>
</tr>
</tbody>
</table>

To achieve the research objectives both primary and secondary data were used to answer the research questions. Questionnaires were used to collect primary data from the respondents. According to (Mugenda and Mugenda, 2003) descriptive data is typically collected through a questionnaire survey. Questionnaires consisting of structured and non structured questions will be used to collect data from the business owners, supervisors and other staff members. The structured questions were used to collect quantitative and qualitative data by analyzing the following variables; technology, flexibility and innovation, access to financing and strategic planning.

The researcher sought for permission to carry out the research from the SME owners in Bomet Town. The researcher’s own opinion did not influence the respondents to answer questions in a certain manner. There was no verbal or visual clue to influence the respondent. The respondents only gave what was required and therefore remained relevant to the objectives of the study and therefore all the data given was useful to the researcher. The questionnaires were hand-dropped and picked later for analysis.
was deemed appropriate as the researcher was closer to the respondents. The researcher used one questionnaire with common questions to all the respondents. The respondents just needed to indicate the level they were working in the organization. The point of the data collection was the SMES in Bomet Central Business District, Bomet County.

In order to test validity of the research instruments, the researcher sampled ten questionnaires; picked 10 respondents of the target population before the actual research period for a sample study as part of the pilot test study. This helped the researcher to test how reliable the data collected by the questionnaires would be. To ensure that there was consistency in the data resulting from this study, measures such as isolating respondents to ensure that answers to specific questions are not discussed, were employed during data collection to limit interference with the integrity of the results.

Reliability was ascertained by pre-testing the questionnaire with a selected sample of employees from a few employees from the selected SMEs to eliminate likelihood of biasness. According to Ojo (2003), reliability is also referred to as the degree to which the instrument consistently measures what it intends to measure. This gave the researcher an assurance that the chosen instrument was fit to give the desired result.

Quantitative data was analyzed through the use of descriptive statistics. Tables, charts and percentages were used for data presentation through the help of Microsoft Excel package. A multiple regression analysis was conducted so as to determine the relationship among variables (independent) on the effect of strategic growth factors and performance of MSMEs. Objective data categorization methodologies were used to isolate and highlight relevant trends. Averages, dispersion frequencies and percentages served accurately this purpose. There was further processing for presentation of results in a variety of graphs and charts using Ms Excel. Conclusions were then drawn from the findings and recommendations made.

4. FINDINGS, SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

4.1 Findings and Discussion

4.1.1 Demographic Information
This sub-section investigates on respondents’ background information; mainly it includes; gender of the respondent, period of service in the business of the respondents.

4.1.2 Gender of the respondents
Respondents were asked to indicate their gender, with a view of establishing the gender distribution of the owners/managers of SMEs in Bomet Central Business District. This was done in view of ensuring fair engagement of respondents in terms of their gender. Results are show in table 4.1

Table 4.1 Gender of the respondents

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>30</td>
<td>57.69</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
<td>42.31</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
<td>100.00</td>
</tr>
</tbody>
</table>

![Graph showing gender distribution of SME respondents](image-url)
Figure 4.1: Gender of the respondents

From the research findings above, the study noted that majority of the respondents as shown by 57.69% were males whereas 42.31% were females. This shows that SMEs in Bomet CBD are mainly dominated by male gender. This call for conducting training through the relevant authorities at the grassroots so that all can embrace the spirit of Smes as a source of income and livelihood and that it can be successfully ran by anyone.

4.1.3 Period of service in the company

The respondents were asked to indicate the period of time they had managed the business or had been working there with a view of determining their ability to articulate issues pertaining their businesses and whether they had an in-depth understanding of the business operations. It is believed that the longer one serves in an organization the more one understands operations of the organization and higher are better equipped to tackle issues related to the business; the Table 4.2 below summarizes the responses.

<table>
<thead>
<tr>
<th>Years of service</th>
<th>Frequency</th>
<th>Percentage Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 and below</td>
<td>25</td>
<td>48.0</td>
</tr>
<tr>
<td>6 to 10</td>
<td>17</td>
<td>32.7</td>
</tr>
<tr>
<td>11 and above</td>
<td>10</td>
<td>19.3</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 4.2: Years of business/working for the organization

The findings on the table above shows that the majority of respondents (48%) have managed their businesses for a period of 5 years and below, 32.7% have managed for a period between 6 to 10 years and 19.3% have managed the businesses for a period of 11 years and above.

4.1.4 Innovation

The study sought to know whether SMEs engage in innovation at any given time, the respondents were asked whether their flexible production method allows them to alter and modify their products quickly; table 4.3 below gives their responses

<table>
<thead>
<tr>
<th>Flexibility of production Method</th>
<th>Percentage Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>20</td>
</tr>
<tr>
<td>No</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
</tr>
</tbody>
</table>
Findings show that majority of the Smes’ production methods do not allow them to alter or modify their products easily and quickly. The respondents were further asked to give reasons as to why there is delay or no innovation; their responses were as tabulated in the figure below.

### Table 4.4 Obstacles in innovation

<table>
<thead>
<tr>
<th>Obstacles in innovation</th>
<th>Frequency</th>
<th>Percentage Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Time</td>
<td>5</td>
<td>9.61</td>
</tr>
<tr>
<td>Lack of money</td>
<td>10</td>
<td>19.23</td>
</tr>
<tr>
<td>Risk-averse culture</td>
<td>20</td>
<td>38.46</td>
</tr>
<tr>
<td>Unsuccessful past innovations</td>
<td>10</td>
<td>19.23</td>
</tr>
<tr>
<td>Company content with current position</td>
<td>7</td>
<td>13.47</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>52</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Some respondents stated other obstacles that included lack of a shared vision, purpose and/or strategy, Short-term thinking/focus, lack of spec time to develop new ideas and opportunities, leadership expects payoff sooner than is realistic, lack of a systematic innovation process, inadequate understanding of customers, unwillingness to change in the absence of a burning platform, unwillingness to acknowledge and learn from past “failures”, politics – efforts to sustain the status quo to support entrenched interests, absence of user-friendly idea management processes.

### 4.1.5 How financing has affected your business

The study sought to establish the sources of funds as well determine finances contributed to the growth of the Msmes. The respondents were asked to state whether they have borrowed money from financial institutions. 40 out of the 52 respondents have ever applied for a loan from a financial institution while the other 12 got their seed capital from own savings, friends and own equity or from disposal of personal assets.

The respondents were asked to state how loan from financial institutions have affected their businesses. Their responses were as follows:

### Table 4.5: Effects of financing on business growth

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Frequency percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>20</td>
<td>38.46</td>
</tr>
<tr>
<td>Good</td>
<td>15</td>
<td>28.84</td>
</tr>
<tr>
<td>Fair</td>
<td>10</td>
<td>19.23</td>
</tr>
<tr>
<td>Poor</td>
<td>5</td>
<td>9.61</td>
</tr>
<tr>
<td>Not at all</td>
<td>2</td>
<td>3.86</td>
</tr>
</tbody>
</table>
Majority of the respondents stated that the loans have had a very good impact on the growth of their business since they were able to buy more stock as well as opening branches in other parts of Town. 15 of the respondents described the loan impact as good, 10 of them felt the impact was just average as they were able to make small profits 5 of them felt that the impact was poor as they stated that much of their profits go back to loan repayment.

The respondents were further asked to state how affordable the credit facilities at their disposal are. Their responses were as below:

**Table 4.6: Affordability of credit facilities**

<table>
<thead>
<tr>
<th>Affordability</th>
<th>Frequency</th>
<th>Frequency Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Affordable</td>
<td>15</td>
<td>28.84</td>
</tr>
<tr>
<td>Affordable</td>
<td>20</td>
<td>38.46</td>
</tr>
<tr>
<td>Not affordable</td>
<td>5</td>
<td>9.61</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>12</td>
<td>23.07</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>52</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Figure 4.6: Affordability of credit facilities**

From the findings above majority i.e. 38.46% of the respondents felt that loans are affordable owing to the fact that business loans were offered at reasonable interest rates and flexible repayment periods since they had established a good rapport with the lending institutions owing to being repeat customers. Those with well established businesses felt that the loans were way very affordable since they did not encounter hitches in the loan application processes and could even repay their loans within a very short period. 9% of the respondents felt that the loans were way too expensive since most of the profits were channeled towards loan repayment and therefore they felt the loans are more exploitative than beneficial. 23.07% of the respondents had not taken loans and therefore they didn’t know how to rate the same.

**4.1.6 Technology**

The study was carried out to establish whether technology was in any way affecting the performance of Micro and small medium enterprises in Bomet CBD, Bomet County. The respondents were further asked to state how adoption of technology had affected their business operations. Their responses were as below:

**Table 4.7: How adoption of technology has affected business operations**

<table>
<thead>
<tr>
<th>Technology effect</th>
<th>Frequency</th>
<th>Frequency Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positively</td>
<td>37</td>
<td>71.15%</td>
</tr>
<tr>
<td>Negatively</td>
<td>5</td>
<td>9.61%</td>
</tr>
<tr>
<td>Not at all</td>
<td>10</td>
<td>19.24%</td>
</tr>
</tbody>
</table>
Figure 4.7: How adoption of technology has affected business operations

The nature of business at Bomet CBD was such that technology had to be used at all times and this was the reason why all respondents in the study employed technology as part of growth. Areas like tailoring, bakeries could not function without using relevant technology like sewing machines and ovens respectively.

On the other hand boutiques, furniture making, electronic dealers used technology mainly for marketing and taking orders; this is made possible through the use of facebook, twitter, websites, instagram to engage with the customers and the would-be-clients.

Majority of the respondents (71.15%) agreed that technology had positively affected their business owing to ease of communication and availability of gadgets that made operations easier. Use of appropriate technology by the respondents was mandatory in order to produce quality competitive products for the market. Appropriate technology today embraces an approach to the management of technical change which was participative in use of resources, knowledge and skills of the people involved (Oketch et al, 2002).

Table 4.7: How introduction of Ict has affected the sales revenue

<table>
<thead>
<tr>
<th>Effect of ICT on sales revenue</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>42</td>
</tr>
<tr>
<td>No</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
</tr>
</tbody>
</table>

Figure 4.7: How introduction of Ict has affected the sales revenue

The respondents who stated yes in the above question were asked to further give how their sales revenues has been affected and their responses were as per the table below

Table 4.8: How Ict has influenced Sales Revenue

<table>
<thead>
<tr>
<th>Effect of ICT on sales revenue</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Positive</td>
<td>20</td>
</tr>
</tbody>
</table>
Positive 10
Negative 7
Very Negative 5

Total 42

Figure 4.8: How Ict has influenced Sales Revenue

20 of the respondents; this comprised of businesses that have been in existence longer others, stated that adoption of ICT had very positively affected their sales revenue since they were able to get more orders online and employed machinery that made their operations easier and thus translated into high revenues. 10 respondents stated theirs to be a positive effect since they had just adopted the same and they were still learning a few things here and there. 7 respondents felt that the effect was negative since at the initial stages they had to incur huge costs installing machines and making of websites and thus eating up their profits. 5 respondents responded that the effect was very negative since they lacked the knowhow on how to use ICT in their operations coupled with large amounts of capital that were used in the process.

4.1.7: Rating E-Marketing’s effect on the business
The respondents were asked to rate E-marketing’s effect on their businesses and their responses were as below

Table 4.10: E-Marketing’s effect on the business

<table>
<thead>
<tr>
<th>E-marketing Effect on business</th>
<th>Frequency</th>
<th>Frequency Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>20</td>
<td>38.46</td>
</tr>
<tr>
<td>Good</td>
<td>15</td>
<td>28.84</td>
</tr>
<tr>
<td>Fairly Good</td>
<td>10</td>
<td>19.23</td>
</tr>
<tr>
<td>Poor</td>
<td>7</td>
<td>13.47</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
<td>100</td>
</tr>
</tbody>
</table>
Figure 4.10: E-Marketing’s effect on the business

Electronic procurement, commonly referred to as e-procurement, defines the automation of procurement and supply chain processes using internet based applications and technology. This expands the idea of enterprise resource planning (ERP) systems, allowing the automation of internal business processes, thus providing a platform that supports automation at a global level. It allows procurement professionals across the world to communicate information simply and efficiently, streamlining the global procurement process; reducing time and costs without compromising on standards and quality.

The respondents were asked to state how E-procurement has affected their businesses and their responses varied from; efficiency in operations, Shortened order and delivery time, increased customer base owing to online clientele, reduced costs of going round taking orders.

4.1.8: Strategic planning

The respondents were asked to state whether they had an existing strategic plan that clearly showed their goals, actions and identifies a responsible charged with carrying the allocated roles in order to achieve the organization’s goals and objectives. Their responses were as tabulated below;

Table 4.11: Existing Strategic Plan

<table>
<thead>
<tr>
<th>Existing Strategic plan</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>30</td>
</tr>
<tr>
<td>No</td>
<td>15</td>
</tr>
<tr>
<td>Don’t know</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>52</strong></td>
</tr>
</tbody>
</table>

Figure 4.11: Existing Strategic Plan

The respondents were further asked to elaborate how the existence of a strategic plan has impacted on their business performance with a view of establishing whether the document was useful in any way. They responded as below;

Table 4.12: Impact of strategic plan on performance on the business

<table>
<thead>
<tr>
<th>Impact on business</th>
<th>Frequency</th>
<th>Frequency Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positively</td>
<td>35</td>
<td>67.30</td>
</tr>
<tr>
<td>Negatively</td>
<td>12</td>
<td>23.07</td>
</tr>
</tbody>
</table>
Majority of the respondents (67.30%) stated that the existence of a strategic plan had aided in planning, allocation of resources, having clear objectives and working towards an existing vision and mission. They further stated that the strategic plans helped them to take stock of their actions and where there were deviations they would zero in on that and make necessary corrections. On the other hand 23.07% of the respondents felt that the strategic plans had not aided them at all since they were viewed as documents prepared but not adhered to, the preparation process did not also involve all users hence there was no ownership of the document. The other 9.63% of the respondent said that they have not seen any advantages of the document since they never understood how to go about the implementation of the strategies stated in the document since they lacked the required resources and skills.

4.1.9: Does everyone participate in the strategic planning process
The respondents were asked to state whether everyone in the organization participate in the strategic planning process. Their responses were as below:

Table 4.13: Strategic planning process participation

<table>
<thead>
<tr>
<th>Participation in the process</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>30</td>
</tr>
<tr>
<td>No</td>
<td>15</td>
</tr>
<tr>
<td>Somehow</td>
<td>3</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
</tr>
</tbody>
</table>

Figure 4.13: Strategic planning process participation

4.2 Summary of Findings

The study analyzed the strategic factors affecting growth of Micro, small and medium enterprises Kenya with a specific focus on Bomet CBD, Bomet County. The research used descriptive research design which enabled the researcher to analyze the strategic factors that affect growth of Smes. The research adopted descriptive research that made use of questionnaires, observation and interviews to collect data from a sample size of 52 SMEs in Bomet Central Business District which were selected using stratified random sampling. A total of 52 respondents to the questionnaires were analyzed. The researcher adopted survey method where a sample of the respondents in the population was interviewed. Data was collected using questionnaires entailing both closed and open ended questions. The collected data was analyzed using graphs, pie charts and tables where conclusions were drawn from the findings and recommendations were made.

The research sought to understand whether technology contributed in any way to the growth of Smes and it was found to be paramount as adoption of technology affected the growth of Micro and small enterprises because small business owners need to produce better quality products for the market so that they are able to compete. Most of the respondents agreed that since they adopted technology they have been able to reach out to more customers and prospects. 71.15% of the respondents agreed that technology had positively impacted on the performance of their businesses evident from ease of communication, efficiency and availability of gadgets that made operations easier.
With respect to accessibility to finances, findings showed that majority of the respondents had accessed loans from financial institutions to facilitate start-up or expansion of their SMEs. Further, the respondents who had never accessed credit were asked to list and briefly explain the reasons for their inability to access credit. The responses are summarized and presented follows: the main obstacles from the SME’s point of view are; lack of information and advice from financial institutions, complexity and inconvenience related to the loan application process. Many documents are required by banks and the average loan application process takes longer than 30 days, inadequate qualification of SMEs, Expenses/fees and interest rate charged lack of collateral, Smes in most cases are viewed as risky entities.

The research findings proved that most Smes rarely engage in innovation simply because they lack financial resources, inadequacy of management and marketing, lack of skilled workers, weakness in external information and linkages, and difficulty in coping with government regulations, risk averse culture, being content with the current situation, to name a few, and all these are factors that limit their competitiveness. This shows that more needs to be done to encourage innovative behavior amongst the MSmes.

Some respondents stated other obstacles that included lack of a shared vision, purpose and/or strategy, Short-term thinking/focus, lack of spec time to develop new ideas and opportunities, leadership expects payoff sooner than is realistic, lack of a systematic innovation process, inadequate understanding of customers, unwillingness to change in the absence of a burning platform, unwillingness to acknowledge and learn from past “failures”, politics – efforts to sustain the status quo to support entrenched interests, absence of user-friendly idea management processes.

The study sought to establish whether Smes had an existing strategic plan, it was noted that almost all had the document but others were not using it as they were used to doing things the old way while those who used the document agreed that it had made work easier for them since goals and objectives were well stipulated and that it had reduced wastage as resources were well allocated towards achievement of goals and objectives. However, more has to be done to instill the strategic planning culture amongst the Smes in order to improve their performance and competitiveness in the business world.

4.3 Study Conclusions
Despite the vital role of SMEs in building a competitive private sector and contributing significantly to employment creation, innovation, and economic development in general, SMEs are facing more challenges around the world in general and in developing countries in particular. Likewise, Kenyan SMEs are hampered by several factors, which may differ from region to region within the country, between rural and urban areas, between sectors, or between individual enterprises within a sector. However, there are certain challenges that are common to almost all SMEs. These challenges arise from the interaction between external and internal factors.

The study found that adoption of technology had a positive impact on the growth and performance of a business. Respondents agreed that there was efficiency in operations, shortened order and delivery times, increased customer base owing to online clientele, improved communication and marketing, reduced costs of going round taking orders. It can be concluded that technology in Smes improves efficiency thus bringing about healthy competition.

The study also found out that having a strategic plan aided so much in allocation of available and limited resources towards achievement of specific set goals and objectives. However more needs to be done to instill the practice of strategic planning amongst small scale businesses to improve performance and ability to compete for the limited market.

It was also concluded that for one to survive in today’s market one must be innovative so that your products or way of doing business is different from your competitors and that customers have a reason to buy from you and not anyone else. It was also noted that there were so many hindrances to innovation in Smes and that more needs to be done both from the government and personal levels.

The study found out that finances are a key driver in the success of any business venture and Smes are not left out either. Access to finance means smooth business operations in terms of replenishing stock whenever it runs out, payment of salaries and wages on time. Further efforts should be undertaken to develop, expand, and promote a range of financial instruments for SMEs: a diversified array of financial instruments could benefit the SME sector and provide a way forward. In addition, special attention should be devoted to increasing young people’s access to financing. It can be concluded that finances contribute towards growth and performance of the Smes.

4.4 Recommendations
4.4.1 Policy Recommendations

Based on the findings and conclusion of the study, it is recommended that; the government through the ministry of trade and ministry of labour should frequently organize training programmes to education the SMEs managers and their employees on strategic plan development, culture of innovation, importance of technology so that they are not rendered obsolete in the fast changing market. The government should also provide financial incentives to the Smes maybe through channeling of funds to an appointed bank so that the same can be loaned to Smes at subsidized interest rates. The managers should also initiate motivation schemes for their employees in order to encourage them to participate in strategic plan development and innovation in their respective SMEs.
Technology is an important aspect in any business venture and therefore SME owners need to invest more on the same and be on look out for the constant changing technologies so that they are not rendered obsolete in their operations. Technology also makes work efficient and easier and goes a long way in improving communication between the business and its customers or prospects.

One of the keys to any successful business is being able to come up with new ideas to keep operations, products and services fresh. The process of bringing those ideas to reality is called innovation. While thinking up new ideas is one step of the process, businesses have a much greater task in trying to turn that into an actual product or service that will benefit customers.

Creative ideas and innovative approaches can come from almost anywhere- from your partners, customers, target groups, employees. They can bring you fresh perspectives and ideas, so show them that you’re listening and open to their feedback. That's why it is important an open exchange of ideas to be supported and encouraged by the company. It is therefore recommended that SME owners should cultivate an innovation culture where all in the organization participate in bringing out ideas that they think are viable and will give them a competitive edge over their business counterparts.

Access to finance is essential to the survival and performance of any business enterprise. As it is the lifeblood of any business enterprise and no business no matter how well managed can survive without enough funds for working capital, fixed assets investment, employment of skilled employees and development of markets and new products and the availability of finances is therefore associated with productivity and growth. It is therefore recommended that funds be set aside by the government so that they can be loaned to SMEs at subsidized interest rates.

5.4.4 Strategic planning

Strategic planning is important to an organization because it provides a sense of direction and outlines measurable goals. Strategic planning is a tool that is useful for guiding day-to-day decisions and also for evaluating progress and changing approaches when moving forward. In order to make the most of strategic planning, an organization should give careful thought to the strategic objectives it outlines, and then back up these goals with realistic, thoroughly researched, quantifiable benchmarks for evaluating results. It is therefore recommended that training be extended to SMEs so that they embrace the importance of the strategic plan and also should taken through steps of preparing the same so that they are not wasteful is allocation of resources.

4.4.2 Recommendations for Further Studies

The study also recommends further studies in the other counties within Kenya in order to establish whether the same conclusions will be arrived at. This will further affirm the theories underlying the study or even come up with new theories that will fill the knowledge gaps.

REFERENCES


Kamau, P and Munandi, I (2009), Innovation in the Kenyan Clothing sector and its impact on employment and poverty reduction. Available online: acfrn.uonbi.ac.ke.innovation in Kenya (February,25 2013)


Morse, E.A., Fowler, S.W., & Lawrence, T.B. (March, 2007). The impact of virtual embeddedness on new venture survival: Overcoming the liabilities of newness. Entrepreneurship Theory & Practice, 139-159.


THE IMPACT OF EQUITY BANK SERVICES ON INDIVIDUALS AND ORGANIZATIONAL PERFORMANCE WITHIN NAIROBI

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ABSTRACT: This paper presents a well elaborate study on the impact of Equity bank services on individuals and organizations performance. It will seek to highlight the effects of the decision making by the top management and the effects of the strategic decision making by the leadership. An evaluation will also be carried out to ascertain the results obtained as a result of use of modern technological innovation within the banking sector and in Equity bank in particular. The target population included the 240 staff from the Equity bank of Kenya in the NCBD and its environment as well as he head office. A sample of 20% (48 respondents) was selected using stratified random sampling from within each group in proportion. Both qualitative and quantitative data was collected by aid of both primary and secondary data. Data was analyzed using SPSS software and presented through aid of frequency tables and charts. The study established that innovation is the reason behind the flourishing and top market leadership position of equity bank. Technology was highly rated to be influencing the success and high performance of Equity bank. On the relationship between consumer relations and success of Equity bank, most of the respondents argued that consumer relations affect the high performance of the management. Majority of the respondents attributed employee competence to high organizational performance in equity bank.

Key Words: Customer Relationship, Technology, Organizational Performance

1. INTRODUCTION

Due to high demand of financial services and security by people within Nairobi who are mainly small business entrepreneurs by the reason of operating mostly as sole proprietors and partners. Equity bank retains a passionate commitment to empowering its client to transform their lives and livelihoods through a business model that is anchored on access, convenience and flexibility of their services. The bank has evolved to become an all-inclusive financial services provider with growing pan-African footprint in Nairobi. Equity Bank’s businesses model and its visionary leadership has continued to earn recognition in Nairobi.

The high level of economic activities within Nairobi caused Equity bank to establish the equity group foundation in 2010. This innovation and creative vehicle has fully transformed the concept of social responsibility, while Equity group foundation champions the socio-economic transformation of the people the socio-economic transformation of the people of Nairobi and seeks partnership. In addition Equity bank has been involved in socio-economic activities such as education and leadership development, financial literacy and entrepreneurial development, agriculture, health, innovations and environment which Links and booms (1983) attribute to quality service delivery and thus positive long-term relationship between organizations and their customers which results in increased firm profitability.

Since the cost of operating and maintaining the business activities is very high therefore many businesses enjoy a greater goodwill. This has encouraged people to migrate from the rural areas to Nairobi, which has led to the increased level of unemployment and high demand for housing (Taborda, 2000). Equity bank has encouraged the people to save their money through deposits with the bank both in form of mortgages for home ownership plan and also for developing the business. Consequently this has enabled the efficient financial flow from the savers to the lenders. Due to the increased customer base Equity bank was recognized amongst Kenya top tax payers in November 2013, because the bank is committed to continue upholding the highest standards of corporate governance and to make a contribution in building the nation.

Therefore, due to the increased customer relations and expansion of the bank’s operations, it emphasizes on various parameters including customer care services, innovative and outreach (Lawler, 1999). The bank will also continue to make significance impact in business through economic growth by creating employment and spearheading innovation in the African continent having the most
influence on the event of the years gone by. This new trend in Equity bank has facilitated out need to conduct the research study on the impact of Equity bank services on the individual and organization’s performance.

The first critical success factor of the bank is about an organization culture that values people, enhances performance and supports the business (Avolio, 1999). This has led to the greater extent of the bank to utilize its human resources in decision making since their proposal are highly considered the staff are influenced positively because their skills and efforts are recognized by the equity bank.

Proper decision by the top management team and also incorporating the decision of the other staff has greatly influenced the organization performance. Equity bank group as a financial service provider has reported a 20% annual profit growth margin for the period ended 31st March 2016. The profit before tax increased from Kshs. 6.1 billion To Kshs. 7.3 billion While a profit after tax rose from 4.3 billion to Kshs 5.1 billion for the same period last year (Equity Bank Report, 2016).

The bank restructured its balance sheet to take full advantage of the prevailing micro economic environment and optimize on earning cash and non cash equivalent which are non-earnings were reduced by 22%. The deployed investment in government securities that grew by 28% to take advantage of the prevailing high interest on treasury bills and bonds of nearly 20% complementing a 22%. On the other hand the deployed investment in government securities that grew by 28% to take advantage of the prevailing high interest rate on treasury bills and bonds of nearly 20% complementing a 22%. The growth in loan book to deliver 36% growth in interest income and growth yield on interest earning assets from 12.5% to 14.5% (Equity Bank Report, 2016).

This study was aimed at determining the influence of the top management of Equity bank on its performance, assessing the extent to which top management of the bank are used to make strategic decision, determining the influence of top management’s demographic and cognitive characteristics on organizational performance and evaluating the influence of top management on organizational decision making.

2. LITERATURE REVIEW

2.1 Agency banking in Kenya

Agency banking took effect in Kenya in May 2010 after the publication of prudential guidelines by the central bank of Kenya. Agency banking is a category in banking that is branchless where third parties are used by the bank in performing some of the activities that are traditionally performed in banking halls by bank personnel (King’ang’ai et al., 2016). In a research conducted by the Central Bank in Nigeria (2013), agency banking is described as the provision of the authority by bank to a third party so that he or she can serve the bank customers on its behalf. In addition, agent banking can also be described as the use of a third-party agent licensed by the particular bank or any other prudentially regulated financial firm to provide banking services to its customer on its behalf (Oxford Policy Management Ltd, 2011).

Ndungu and Wako (2015) describe agency banking as the use of third party licensed agents to provide the bank’s customers with certain services on behalf of the bank. Also known by the term correspondent banking, agency banking is a model that allows the delivery of financial services to bank customers located in areas where banks may be uneconomical running a branch.

This model as Rezwan and Sandip (2015) outline holds great potential in revolutionizing the banking industry and significantly help close the delivery gap. To be in a position to offer the services, banks provide the agents with reader devices at point of sale, bank agent, and a barcode scanner necessary for scanning bills paid through them. Clients accessing the services from an agent make use of the banking agent provided to them by the bank to enable them have access to their bank accounts or electronic wallet respectively (Njogu & Wanyoike, 2014). Agent banks provide regular banking functions such as deposit taking and withdrawals, disbursing and also repayment of loans, payments of salaries, payouts of pensions, transfer of funds as well as issuing of mini statements through an infrastructures of a shared nature (Mosoti & Mwaura 2014).

Agency banking as a strategy of expansion depicts its concept from the branchless banking model into which the wordings are will use interchangeably. Agency banking also assists decongesting banking halls by letting the customers receive banking services elsewhere (King’ang’ai et al., 2016). Agency banking makes it possible for customer of the bank to have access to the banking services within reach and at the very comfort of the neighborhood. Agency banking has dramatically led to significant reduction in the total costs that go with financial services delivery especially to people in grassroots where it’s hard to run bank branches profitably (Kingori & Gekara, 2015). The agency gives customers a chance for ease accessibility of financial products and related services at a
places that are proximal and within reach by the customer. Such an opportunity eliminates barriers such as accessibility and timeliness of service delivery (Mutie, Bichanga & Mosoti, 2015).

2.2 Customer Relationship and Use of Technology
The role of Technological innovations on efficiency and cost reduction in the banking sector is paramount for the successful and profitable service delivery in the sector. Kenyan commercial banks have continued to use huge investments in technology based innovations and training of man-power to handle new technologies.

The advancement in technology has provided an opportunity for financial service providers to introduce great innovations (GU, lee & such, 2009). The Kenyan banking sector is embracing digital technology with its due advantages. Internet banking offers the traditional players in the financial services sector the opportunity to add a low cost distribution while designing a digital system hence putting customers’ needs into consideration. It also creates a threat to traditional banks, radically changing business models and redefining customers experience in adoption among Kenyan commercial banks.

Delivering quality service means conforming to customer’s expectation on consistent basis, hence longer relationship (Links & Booms, 1983). Regardless of the types of services consumers use basically similar criteria in evaluating service quality. These criteria seem to fall into seven key categories which are labeled service quality determinants namely: reliability, responsiveness, access, communication, credibility, security as well as understanding the customer (Parasuraman et al., 1985).

The convenience strategic implications and customer perception of M-banking services are explored value creating a better understanding about the customer perceived value of M-banking services. For instance, mobile banking has been quite popular in Japan especially for the young and single consumers. This also applies in the case of equity bank.

According to International journal of innovative research of March, 2013; The M-banking, M-payments, M-transfers and M-finance refer collectively to a set of applications that enable people to use their mobile phones to manipulate their bank accounts, store value in an account linked to their handsets, transfer funds, M-banking or even access credit or assurance products. The first target for these applications was consumers in a developed country and it is done by complementing services offered by the banking system, such as check books, ATMs, voice mail/landline, interfaces, smart cards, print of sale networks, and internet resources, the mobile platform offers a convenient additional methods for managing money without handling cash, (karjaluoto, 2002).

For users in the developing country, on the other hand, the appeal of these M-banking and M-payments systems may be less about convenience and more about accessibility and affordability (Cracknel, 2004). Mobile phone operators have identified M-banking and M-payments systems as a potential service to offer customers, increasing loyalty while generating fees and messaging changes. Partnership between Equity bank and telecommunications provider has facilitated new service and offer a way to transfer money from place to place and provides an attractive opportunity to the payment system offered by the bank’s mobile banking that is indeed effective on cost and dispenses services.

3. RESEARCH METHODOLOGY
The study adopted a descriptive design with an exploratory view which sought to provide an insight and expand the understanding of the management capabilities and leadership strategies used in Equity bank. The study’s aim was to establish which and how these capabilities affected the operations and thus defining who and how much of the operations phenomenon and the question of study.

The target population included the 240 staff from the Equity bank of Kenya in the NCBD and its environment as well as he head office. A sample of 20% (48 respondents) was selected using stratified random sampling from within each group in proportion. This is because the household the Equity bank staff members were so many and to save time and cost involved, it was prudent to use sampling method.

Both primary and secondary data was collected for this study. The primary data sources used includes: Groups: e.g. the information acquired from students who have been sponsored by the equity bank foundation and how they have been successful through sponsorship throughout their lives; Panels; Joint financial advisors and sponsoring stock brokers was to investigate the banking sector in the country and Individuals; before the group information was aggregated each element of the group was interviewed and the report obtained.

The secondary sources comprised database e.g. the financial reports available and view of the both the public, senior staff and other subordinates, Institutional records such organizational charts, records of services provide manuals and standards of the bank and the mission, vision and culture of the equity bank and books. Data was collected by interactive voice responses, self administered questionnaires, computer assisted personal interview and computerized self administered questionnaires.

Collected data was edited and coded for correctness before being analyzed by SPSS software. Analyzed data was presented in the form of frequency tables and charts.
4. FINDINGS AND CONCLUSIONS

4.1 Response Rate
The findings on the response rate reveal that 85% of questionnaires issues to respondents were returned. This response rate is good and perfect as seconded by Mugenda and Mugenda (2003), who argues that a response rate of 60% is good and one which is above 70% is perfect. Since the response rate was 85%, this can be concluded to be excellent representation. This is represented in the table 4.1:

Table 4.1: Response rate analysis

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returned Questionnaires</td>
<td>210</td>
<td>85</td>
</tr>
<tr>
<td>Unreturned Questionnaires</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100</td>
</tr>
</tbody>
</table>

4.2 Gender of Respondents
On the gender of respondents, the study noted that 75% of respondents were male while only 25% were female. The study raises inferences on the need to work on gender balance but for the purpose of this study, the researchers can inference that both genders were well represented. The above narration is explained by the illustration 4.2 below:

Table 4.2: Gender of Respondents

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>180</td>
<td>75</td>
</tr>
<tr>
<td>Female</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100</td>
</tr>
</tbody>
</table>

4.3 Age of Respondents
On the age statistics of respondents, it was noted that many respondents were of the age 19-30 years. The study was therefore pioneered by a vibrant group of respondents who are energetic and focused to grow their careers to the next level. The rest of the respondents were also represented: there was no respondent under 18 years, 33% of the respondents were 31-40 years, 19% of the respondents were 41-50 years and 10% of the respondents were above 50 years. This is illustrated in the figure 4.1 below:

Figure 4.1: Age of Respondents
4.4 Education Level of Respondents

The study established that majority respondents were university graduates as represented by 50% rating while the lowest among them were secondary level finalists as represented by 13% rating. This reveals that the respondents were well qualified to answer the study questions and hence the minimal study requirements. This is illustrated by table 4.3:

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary level</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Secondary Level</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>Tertiary/College Level</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>University</td>
<td>120</td>
<td>50</td>
</tr>
<tr>
<td>Others</td>
<td>40</td>
<td>17</td>
</tr>
<tr>
<td>Totals</td>
<td>240</td>
<td>100</td>
</tr>
</tbody>
</table>

4.5 Position Status of Respondents in Equity Bank

The study established that many respondents were from the lower level of management as represented by 42% followed by the middle level of management as represented by 32% and finally the senior level of management were the least as represented by 26%. The statistics reveal that all management levels were well represented in this study as illustrated by figure 4.4:

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Management</td>
<td>63</td>
<td>26</td>
</tr>
<tr>
<td>Middle Level Management</td>
<td>77</td>
<td>32</td>
</tr>
<tr>
<td>Lower level Management</td>
<td>100</td>
<td>42</td>
</tr>
<tr>
<td>Totals</td>
<td>240</td>
<td>100</td>
</tr>
</tbody>
</table>

4.6 Innovation and Success of Equity Bank

Reference table 4.5 reveals that majority of the respondents (59%) strongly agreed that innovation is the reason behind the flourishing and top market leadership position of equity bank while 31% agreed that innovation influences the success of the Equity bank. Only 4% disagreed and 6% disagreed as illustrated by table 4.5:

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>85</td>
<td>59</td>
</tr>
<tr>
<td>Agree</td>
<td>50</td>
<td>31</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Disagree</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Totals</td>
<td>160</td>
<td>100</td>
</tr>
</tbody>
</table>

4.7 Technology and Success of Equity Bank

According to the reference table 4.6, most of the respondents (46%) agreed, 34% strongly agreed 16% disagreed and 4% strongly disagreed that technology influences the success and high performance of Equity bank. It implies that majority were in agreement that technology affects the choice of the technological strategy to be used. This is hereby illustrated in table 4.6:

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>85</td>
<td>59</td>
</tr>
<tr>
<td>Agree</td>
<td>50</td>
<td>31</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Disagree</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Totals</td>
<td>160</td>
<td>100</td>
</tr>
</tbody>
</table>
4.8 Consumer Relations and Success of Equity Bank

On the relationship between consumer relations and success of Equity bank, most of the respondents (57%) agreed, 29% strongly agreed, 10% strongly disagreed and 4% disagreed that consumer relations affects the high performance of the management. It implies that majority were in agreement that consumer relations between the Equity bank’s management and employees and the customers always affect the performance. This is illustrated in table 4.7 below:

Table 4.7: Consumer relations and Success of Equity Bank

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>40</td>
<td>29</td>
</tr>
<tr>
<td>Agree</td>
<td>80</td>
<td>57</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Totals</td>
<td>140</td>
<td>100</td>
</tr>
</tbody>
</table>

4.9 Employee Competence and Success of Equity Bank

Reference table 4.8 reveals that majority of the respondents (59%) strongly agreed 30% agreed while 4% disagreed that employee competence affects the performance. This shows that employee competence affect the top management and the employees. This can be properly explained by the cognitive characteristics that make the people in the management. This is illustrated by the table 4.8:

Table 4.8: Employee Competence

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>88</td>
<td>59</td>
</tr>
<tr>
<td>Agree</td>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Totals</td>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>

5. RECOMMENDATIONS AND AREAS FOR FURTHER RESEARCH

5.1 Recommendations

The following recommendations were made:

i. It’s therefore recommended that banks should adopt a risk-based approach to the supervision and regulation of agency banking.

ii. Enough security measures should be put in place. Agency banking as branchless banking model has enabled banks to reach the unbanked population. Its therefore critical that banks should allow agents to be more financially inclusive than just offering the cash transfer services agents should be able to covert cheques into cash, deal with foreign currently exchange among other services.

iii. The selection criteria of agents should be restructured so as to favors heavy cash operations in order to meet the demand of cash availability as well as handling large transactions.

iv. The bank should strive to look for more shareholders by increasing the issuance of its share to the public so as to continue increasing its capital base.

v. Equity bank should be able to come up with a unique strategies that the competition does not practice such as creativity, social responsibilities, customer retention, E-marketing and organizational relationships.

vi. For innovation to yield optimum impact, firms have to invest in market research so as to understand the industry, competition and customer’s expectation. A close interaction with customers provides the most effective platform for market research.
vii. The banking sector and other organizations should invest in knowing their customers since they provide early warning signals about the products quality and timeliness.

viii. Many banks today are moving away from traditional practices and adopting forward thinking best practices to support profitability value. These best practices should be applicable to every area of banking as to the industry changes.

5.2. Areas of Further Research

The study was limited to Equity bank Kenya only in Nairobi area where the study was to examine the impact of Equity bank services to the individuals and organization within Nairobi, an also the role of leadership in the management of strategic change. A similar research should be conducted in a different context in order to affirm the findings of this research as well as other researchers who have done the same research.

The study recommends the need for further research to establish the leadership style most suited for managing change efficiency in organizations. While the numerous positive outcome of transformational leadership are indeed impressive including positive effect of follower’s effort, performance job satisfaction and organization commitment and leadership effective during period of organization change, the literature remains surprisingly deficient in studies that examine the ethical values and moral underpinnings of transformational leadership.

Leadership research is also needed to link the specific leadership styles of leadership to follower attitudes in organizations.

Finally future research is needed to further clarify the specific moral and ethical qualities of transformational leaders such as integrity, self-transcendent values and compassion which may offer stronger explanation power of leadership style, follower attitudes and consequential behaviors. Overall, the future study of transformation from continuing empirical efforts to better understanding how specific behavior styles are linked to successful management of change.

REFERENCES


Bainbridge C. (1996). Designing for change; A practical guide for business transformation


SCROTAL ULTRASONOGRAPHY IN THE ASSESSMENT OF SUBFERTILE MALES

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Abstract- Subfertility is defined as a failure to conceive after one year of unprotected regular sexual intercourse. A prospective study was conducted to identity the role of ultrasonography in assessing the cause of male subfertility in a Sri Lankan population. The objective of the study was to identify the role of ultrasonography in assessing the cause of male subfertility in a Sri Lankan population. The sample consists of 86 patients referred for scrotal ultrasonography for the assessment of male subfertility. Ultrasound scan of the scrotum was done for the assessment of the testicular volume, testicular pathologies and extra testicular pathologies. The patients who were azoospermic or had seminal fluid volume less than 2.5ml were subjected to Trans Rectal Ultrasound Scan (TRUS) to exclude any obstruction to the seminal fluid pathway. As the results mean duration of subfertility was 4.47 (SD=2.63), 91.9% of the study population had primary subfertility while 8.1% had secondary subfertility. Testicular volume was calculated using three measurements and the formula of an ellipsoid. The mean ultrasonic testicular volume of the right testis was 7.66 cm³ (SD=4.24), and that of the left was 7.43 cm³ (SD=4.5). 44.2% of patients had some abnormality detected by ultrasound scan while 55.8% had normal ultrasonography. 26.8% (n = 23) of the sample had varicocele and of which 73.91% (n = 17) was on left side only, 17.39% (n = 4) had only right sided varicocele and 8.69% (n = 2) had bilateral disease. 4.7% of patients had epididymal cysts and 4.7% had testicular microlithiasis. When considering the echo pattern of the testis 77.9% (n = 67) had normal echo pattern but 1.4% (n = 1) had heterogeneous echo pattern. As a conclusion the commonest abnormality detected in sub fertile men was a left sided varicocele. However there was a significant difference in the mean testicular size of Sri Lankan sub fertile men.

Index terms- Subfertility, testicular volume, ultrasonography

I. INTRODUCTION

Subfertility is defined as a failure to conceive after one year of unprotected regular sexual intercourse. Subfertility can be primary or secondary and there are multiple male and female factors responsible for subfertility. [Alison Taylor]

Male subfertility can be caused by congenital or acquired urogenital abnormalities, genetic and immunological factors, endocrine disturbances, genital tract infections and erectile dysfunction, which can be divided into pretesticular, testicular and post-testicular, causes. Initial screening for male subfertility involves semen analysis, repeated at 4–6 weeks if abnormal. Once male subfertility is established, urological referral is undertaken. Evaluation of the subfertile male includes detailed history and physical examination, followed by laboratory tests and imaging. (Ammar, Sidhu and Wilkins, 2012)

The three main imaging modalities used for investigation of the male reproductive system are ultrasound, MRI and invasive techniques such as venography and vasography. Ultrasound remains the mainstay as it is non-invasive, safe and widely available, and is able to define many of the abnormalities relevant to male subfertility. (Ammar, Sidhu and Wilkins, 2012)

Scrotal US is a first-line, basic imaging tool for all scrotal abnormalities, and it has also been demonstrated that testicular volume as measured by scrotal US is significantly correlated with testicular function. An increased resistive index and pulsatility index of the capsular branches of the testicular arteries on unenhanced color Doppler US examination may indicate impaired testicular microcirculation in patients with clinical varicocele. Doppler US is a promising method for assessing patients who are affected by azoospermia. (Gudealoglu and Parekattil, 2013)

Trans-rectal ultrasound (TRUS) enables high-resolution imaging of the prostate, seminal vesicles and vas deferens and is the modality of choice in diagnosing congenital and acquired abnormalities implicated in the cause of obstructive azoospermia. (OA) (Ammar, Sidhu and Wilkins, 2012)

In a study done by Tijani et al in 2009 using 149 patients with diagnosis of male infertility and 100 healthy individuals, they performed scrotal ultrasound scans in all the subjects using a high frequency (7.5 MHz) linear transducer of an ultrasound scanner. Images in B-mode ultrasound scan and color Doppler were acquired in the supine and upright position. According to their results, the
prevalence of abnormal scrotal findings in the sub-fertile and fertile men was 65.1% and 23% respectively. Varicocele was the commonest and was found in 55% and 12% of the sub-fertile and fertile men respectively. Hydrocele and epididymal abnormalities were the next common with higher prevalence in the sub-fertile men and they concluded that except varicocele, there was no statistically significant difference in the prevalence of the other abnormalities between the sub-fertile and fertile groups (Tijani et al., 2014).

In a retrospective study done by Hillelsohn et al in 2013 using 99 patients with non-obstructive male subfertility they concluded that an intratesticular RI greater than 0.6 is associated with impaired spermatogenesis, and it supports the use of testicular spectral Doppler sonography as a noninvasive tool for evaluation of testicular function. (Hillelsohn et al., 2013)

In a study done by Qublan et al in 2007 using 234 infertile men, subjects were evaluated for the presence of intra- and extra-testicular abnormalities using high-frequency transducers and color Doppler imaging. They found out that there is a statistically significant increase in the prevalence of abnormal scrotal findings detected with sonography in the study group compared to controls. These included varicocele in 35.5% versus 16%, hydrocele in 16.7% versus 8.7%, testicular microlithiasis in 9.8% versus 2%), epididymal enlargement in 9% versus 2.6% (p < 0.05), and epididymal cyst in 7.7% versus 2%. (Qublan et al., 2007)

Sakamoto et al have done a study on Color Doppler ultrasonography as a routine clinical examination in male infertility in 2006. They performed color doppler ultrasonography in 545 infertile men and they found out that Intra-scrotal abnormalities were detected by ultrasonography in 65.3% of patients. Of them, 58.3% were undetected by physical examination. Left varicocele was found in 57.4%; testicular microlithiasis in 5.5% epididymal cyst in 3.9%; right varicocele in 0.8%; and testicular cysts in 3 0.6%. (Sakamoto et al., 2006). The objective of the study was to identify the role of ultrasonography in assessing the cause of male subfertility in a Sri Lankan population.

II. METHODOLOGY

This is a prospective study conducted during a period of 3 years at the Teaching Hospital Peradeniya, Sri Lanka. The sample consists of 86 patients referred for scrotal ultrasonography for the assessment of male subfertility. All the patients were scanned using a 7.5 to 10 MHz linear transducer of Sonoline G 50 ultrasound scanning machine by a single consultant radiologist. Ultrasound scan of the scrotum was done for the assessment of the testicular volume, testicular pathologies and extra testicular pathologies. The patients who were azoospermic or had seminal fluid volume less than 2.5ml were undergone Trans Rectal Ultrasound Scan (TRUS) to exclude any obstruction to the seminal fluid pathway. The findings were recorded and the patients were followed up.

III. RESULTS

Ultrasound scanning of the testis was performed in 86 sub fertile men and their mean age was 35.15 years (SD=5.065) ranging from 25 years to 48 years. Mean duration of subfertility was 4.47 (SD=2.63) 91.9% of the study population had primary subfertility while 8.1% had secondary subfertility. Testicular volume was calculated using three measurements and the formula of an ellipsoid. The mean ultrasonic testicular volume of the right testis was 7.66 cm3 (SD=4.24), and that of the left was 7.43 cm3 (SD=4.50).

44.2% of patients had some abnormality detected by ultrasound scan while 55.8% had normal ultrasonography. 26.8% (n = 23) of the sample had varicocele and of which 73.91 % (n = 17) was on left side only, 17.39 % (n = 4) had only right sided varicocele and 8.69 % (n = 2) had bilateral disease. 4.7% of patients had epididymal cysts and 4.7% had testicular microlithiasis. When considering the echo pattern of the testis 77.9 % (n = 67) had normal echo pattern but 16.3% (n = 14) had heterogeneous echo pattern. (Graph 1)
Graph 1. Testicular echo pattern

Of the 28 patients who underwent TRUS and from them only 2 patients found to be having obstruction of the ejaculatory ducts (7.14%).

IV. DISCUSSION

Scrotal ultrasonography plays an important role in the assessment of male subfertility. And it is almost always the initial imaging investigation in male subfertility. (Ammar, Sidhu and Wilkins, 2012)

In our study group the mean testicular volume of the right testis was 7.66 cm$^3$ and in the left it was 7.43 cm$^3$. In contrasts in a study done by J.D. Schiff et al using 159 subfertile men the mean ultrasonic right testicular volume was 18.3 ml and that of left was 16.9 ml. (Schiff, Li and Goldstein, 2004) In a study done by Adrian Kristo and Evin Dani using 500 male subjects presenting for male infertility they found out that the testicular volume has a direct correlation with semen parameters and the critical mean testicular volume indicating normal testicular function is 13.3 ml. (Kristo and Dani, 2014) But there are no literature available regarding the ultrasonographically measured normal testicular volume in Sri Lankan men. In a study conducted by E. Wikramanayake, in 1995 using 200 Sinhalese men. The mean right testicular size was 17.2 + 4.1 ml and that of the left was 16.1 + 3.9 ml as measured by the orchidometer. The reason for this discrepancy may be due to smaller testicular size in Sri Lankan men compared to world population. But further studies are required to establish the normal testicular size in Sri Lankan men.

44.2% of our study subjects had some abnormality detected by scrotal ultrasonography. In a study done by Hideo Sakamoto et al using 545 infertile men, Intra-scrotal abnormalities were detected by ultrasonography in 65.3% of patients. (Sakamoto et al., 2006) Similarly in a study done by K.H. Tijani et al using 149 subfertile patients and 100 healthy individuals in West Africa They found out that the prevalence of abnormal scrotal findings in the sub-fertile men was 65.1% and in fertile men it was 23%. (Tijani et al., 2014)

In the current study the commonest abnormality detected by ultrasonography was varicocele which was detected in 26.8% of study subjects. It was followed by epididymal cyst (4.7%) and testicular microlithiasis (4.7%) In the study done by K.H. Tijani et al the commonest scrotal abnormality detected by ultrasound was varicocele and it was found in 55% subfertile men, epididymal cyst was found in 5.3%. Most studies have reported varicoceles to be more common on the Left in both sub-fertile men and normal population.in their study Left side varicocele was found in 66.7% and in Right side it was 3.7%. Similarly in our study Left side varicoceles were responsible for 73.91 %. (Tijani et al., 2014)

In the study done by Hideo Sakamoto et al Left varicocele was found in 57.4% of patients and testicular microlithiasis in 5.5%. Epididymal cyst was seen in 3.9%. Right varicocele was seen only in 0.8%. (Sakamoto et al., 2006)
In a study done by Qublan et al using 234 subfertile men including 176 oligospermic 58 azoospermic, and 150 normospermic men they found a statistically significant increase in the prevalence of abnormal scrotal findings detected with sonography in the subfertile group compared with normospermic group. The abnormalities detected in the subfertile group included varicocele in 35.5%, hydrocele in 16.7%, testicular microlithiasis in 9.8% and epididymal cyst in 7.7% versus. (Qublan et al., 2007)

V. CONCLUSION

Commonest abnormality detected in subfertile men was a left sided varicose. This tally with the international literature and however there was a significant difference in the mean testicular size of Sri Lankan subfertile men.

VI. REFERENCES

12. Sensitivity and Specificity of Ultrasonography in Predicting Etiology of Azoospermia

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EFFECTS OF BRANDING STRATEGIES ON RECOGNITION OF CORPORATE BRAND AT EUROPEAN UNION MISSIONS IN KENYA

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Abstract: This research explores the effects of adopting branding strategies for recognition of the EU corporate brand Missions in Kenya. This study also outlines some gaps that exist in the research of corporate branding and formulates a series of related research questions. Corporate brand management is a dynamic process that involves keeping up with continuous adjustments of vision, culture and image. The target population of the study consisted of 200 employees of the European Union Missions in Kenya. A sample size of 133 respondents from eight operations within the EU Missions in Kenya was drawn. Multiple regression was used to establish the effect of branding strategies on recognition of corporate brand at European Union Missions in Kenya. The results showed that corporate social responsibility strategy had a positive effect on corporate brand recognition and improves it by 0.676 standardized coefficients. Brand communities strategy and internal branding strategy had a negative effect on corporate brand recognition reducing it by 0.250 standard deviations and 0.307 standard deviations respectively. Brand asset management strategy was observed to have a positive effect on corporate brand recognition improving it by 0.391 standard deviations.

Key Words: Corporate Branding, Corporate Brand Identity, Brand Communities

1. INTRODUCTION

Corporate brands are increasingly an important element of organisational and marketing strategy (Balmer, 2001; Olins, 2000). A strong corporate brand acts as a focal point for the attention, interest and activity of stakeholders and contributes to organisational identity. The corporate brand attracts and orients relevant audiences, stakeholders and constituencies around recognisable values and symbols that differentiate the organisation. But corporate branding is not only about differentiation, it is also about belonging. The rise of corporate branding has raised awareness of the crucial role employees’ play in the corporate branding process. When corporate branding works, it is because it expresses the values and/or sources of desire that attract key stakeholders to the organisation and encourage them to feel a sense of belonging to it.

Within marketing, branding and corporate identity studies, we find a growing awareness that corporate brands can increase the company’s visibility, recognition and reputation in ways not fully appreciated by product-brand thinking. The corporate brand contributes not only to customer-based images of the organisation, but to the images formed and held by all its stakeholders, including: employees; customers; investors; suppliers; partners; regulators; special interests; and local communities. Furthermore, with the ubiquity of technology decreasing the potential for sustained competitive advantage, managers are focusing more on differentiating their Brands on the basis of unique emotional, rather than functional, characteristics (De Chernatony et al., 2001). It is this attraction and sense of belonging that affects the decisions and behaviours on which a company is built. A strong corporate brand taps this attractive force and offers symbols that help stakeholders experience and express their values and thereby keep them active.

The importance of employees to corporate branding and the need to better understand their behaviour and thus the organisational culture of the corporation have received particular emphasis in recent work. Harris and de Chernatony (2001), Hatch and Schultz (2001) as well as Wilson and Balmer (2001) have all argued that employees are key to building relationships with all the organisation’s stakeholders as well as contributing to the meaning of the brand (i.e. by expressing to others who we think we are as an organisation).

Earlier research identified several factors influencing the global Branding strategies (Gabrielsson & Gabrielsson, 2003; Loustrarinen & Gabrielsson, 2004); and also factors influencing Branding strategies. In the corporate brand tool kit developed by Hatch and Schultz (2001), the gaps between strategic vision, organisational culture and corporate image serve to identify key
problem areas for corporate brands. As corporate branding is about multiple stakeholders interacting with the organisation’s employees, its success largely relies on employees’ attitudes and behaviours in delivering the brand promise to external stakeholders (Schultz, & De Chernatony, 2002). To be recognised as a high-performing corporate brand, organisations have to understand and orchestrate their employees to align their attitudes to brand values and encourage a brand supporting behaviour. The corporate brand must resonate with the tacit meanings and values that organisational members hold and use (i.e. their actual identity). To create an authentic corporate brand, the organisation should build on the cultural values that produce the tacit symbolic meaning of the organisation. This implies that organisational members are important contributors to the creation of corporate brand value. The corporate brand most likely to succeed is one that directly connects strategic vision and organisational culture.

Corporate branding refers to the practice of promoting the brand name of a corporate entity, as opposed to specific products or services. The activities and thinking that go into corporate branding are different from product and service branding because the scope of a corporate brand is typically much broader. Corporate brands are characterised by their cultural, intricate and tangible elements and should demand total organisational commitment. In most instances, the conscious decision by senior management to distil the attributes of the organisation’s identity in the form of a clearly defined branding proposition. This proposition may be viewed as a covenant with key stakeholder groups and networks which underpin an organisation’s effort to communicate differentiate and enhance the brand by means of concerted communicated message or messages across multiple channels of communication. Corporate branding management requires senior management support (Balmer, 2001).

Corporate branding efforts generally involve projections of the company’s distinctiveness by using the total corporate communication mix to influence external audiences, who are thereby encouraged to perceive and judge the organisation and its multiple offerings as attractive and desirable. Such images are expected to influence stakeholder behaviour in ways that generate brand equity at the corporate level (Keller, 2000).

Management practice suggests that stronger brands result from a consistent corporate brand identity with harmonised identity components. The EU Missions in Kenya have completed numerous successful projects and programmes in various sectors such as; infrastructure, communications and transport, water and energy, rural development, agriculture and food security, the environment and the sustainable management of natural resources, health and vocational training and governance. However, there is a major gap in communicating and aligning the EU corporate brand strategy to its employees. Thus, the employees within EU Missions in Kenya do not understand the EU as a corporate brand, its mandates, commitment and its responsibilities especially its stakeholders within whom they interact. As a result, the employees are not able to deliver the brand supporting behaviour and attitudes to the intended audience. In essence, it is through employees understanding their role and through aligning of corporate branding strategies that recognition of the EU corporate brand can be achieved. This study therefore, seeks to determine the effects of corporate branding strategies on the recognition of corporate brand at European Union Missions in Kenya.

The General objective of this study is to determine the effects of branding strategies on recognition of corporate brand at European Union Missions in Kenya. The specific objectives sought to determine the effects of corporate social responsibility on corporate brand recognition at European Union Missions of Kenya, to establish the effects of brand communities on corporate brand recognition at European Union Missions of Kenya, to establish the effects of internal on corporate brand recognition at European Union Missions of Kenya and to determine the effects of brand asset management on Corporate brand recognition at European Union Missions of Kenya.

2. LITERATURE REVIEW

Creating a coherent perception of an organisation in the minds of its various stakeholders is a major challenge faced by many organisations. Particularly in large multinational or international organisations, speaking with one voice is a challenging task. Large organisations often comprise multiple branches or divisions and subsequently multiple brands and cultures. Orchestrating the signals these diverse corporate subdivisions send out to their stakeholders is often impeded by various aspects such as historic turf wars between divisions, cultural and language differences, deficient management structures and unclear responsibilities, or simply by spatial separation. Furthermore, incoherence in messages and difficulties in co-ordination are often fostered by communication representatives’ narrow focus on their particular stakeholder groups.

Certainly, during the late 1990s and the early 2000s, Branding emerged as a significant area of emphasis not only for companies and their products, but also for municipalities, universities, other Non-profit Organisations and even individuals. Branding became ubiquitous. Many consumer product companies began branding their products in earnest in the mid-to-late 1800s. Much of this work has been conceptual and, to date, there has been only limited empirical investigation of the processes that enable an organisation to engage successfully in Corporate Brand management.

Establishing successful Corporate Brand management practices relies on the identification of two factors: the mix of variables that comprise the Corporate Brand and the development of a marketing and brand management system for understanding this process of direction and control. Corporate Branding draws on the traditions of Product Branding in that it shares the same objective of creating differentiation and preference. However, this activity is rendered more complex by managers conducting these practices at the level of the organisation, rather than the individual product or service, and the requirement to manage interactions with multiple stakeholder audiences. There is support in recent literature for an increasing focus on the role of the organisation as a

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strategic element in the Branding process (Abratt & Mofokeng, 2001; Cheney & Christiansen, 1999). It also highlights some of the problems inherent in managing a wider set of variables associated with the organisation.

2.1 Corporate Social Responsibility
CSR has been recognized all around the world as one of the suitable ways that should be applied in any business operations. It is believed that running a business ethically and responsibly will be able to construct a sustainable business success. In so doing, various benefits can be created abstractly and concretely, for example good images and brand valuation can be increased and good reputation of the organizations can be built as well (Bevan et al., 2004; Schaltegger & Burritt, 2005; Weber, 2008).

Apart from these, opportunity sources and innovation creation abilities can be expanded (Porter & Kramer, 2006; Stephenson, 2009; Weber, 2008). CSR also helps the organizations effectively deal with risks caused by social pressures and pressures from benefit groups (Bevan et al., 2004; Schaltegger & Burritt, 2005). Nowadays, CSR is becoming a business standard for any business organizations to provide their society with ethic performances (Cheng & Ahmad, 2010). All in all, CSR plays a vital part in developing businesses to be sustainably successful in the word of increasingly intense competitions these days.

Currently, consideration has been taken into the stakeholders’ decision making involving among others, the organisations social responsibility. So, socially responsible investment has been progressively more concerned. With CSR, socially and environmentally destructive effects can be avoided, different needs of relevant stakeholders can be properly satisfied and high effectiveness of the corporate governance can be balanced. These require leaders who are able to proficiently tackle with such changes. With the qualified leaders, any risks out of the corporate performances can be reduced. This is a new challenge for most organisations.

2.2 Brand Communities
Research on corporate branding has, in recent years, demonstrated a growing reflexivity about how brands are perceived by various actors inside and outside organisations and their responses to those perceptions. Corporate branding needs to be understood not only as a means of positioning, marketing and 'selling' a certain set of associations and images to consumers, it should also consider how consumers, employees, shareholders, suppliers and other interested parties respond to an organisation based on what they think they know about it. The expression of an organisation’s identity (or identities) through multiple channels, media platforms and business functions has, therefore, received increasing attention from scholars in corporate branding (Schultz, Hatch & Larsen, 2000).

Because the organisation is now conceived of as an ‘expressive’ entity capable of influencing the opinions of a range of stakeholders, both internally and externally, several scholars have called for a more integrative and multidisciplinary approach to the study of organisational identity, an approach which can more comprehensively articulate the ways in which organisations perceive themselves and how they want to be perceived by others (Dacin & Brown, 2006; Schultz, Hatch & Larsen, 2000).

2.3 Internal Branding
A strong brand has been found to be instrumental in the facilitation of improved brand loyalty, improved and greater stakeholder value, and clear, valued and sustainable points of differentiation as well as the simplification of decision making and the establishment of expectations (Davis, 2000; Keller, 2003). Employees who are in consensus with an organisation’s brand are more likely to act consistently in ways supporting how the organization hopes that external stakeholders perceive it. By establishing effective systems for the management of the corporate brand, an organisation may engage its employees in its mission and plans (strategic, tactical and operational).

This engagement of employees in branding, leading to their representation of brand qualities to external stakeholders is often times referred to as internal branding, employee branding, or internal marketing (Keller, 2003; Mitchell, 2002). While branding initiatives most frequently focus on external stakeholders, internal branding and/or employee branding efforts establish systems/processes and consequent employee behaviours that are consistent with the external branding efforts.

The terms employee branding and internal branding are essentially synonymous has also been used to describe these activities and programs (Mitchell, 2002). The organisation engages itself in activities to set up the stakeholders’ perception. Delivering the brand promise depends on employees who, during encounters with stakeholders, determine whether the promise is kept or broken. To ensure that employees are able to deliver the brand promise, the organisation needs to engage in any activities and strategies that aid employees in their ability to deliver on brand promise.

Hatch and Schultz (2001) stress the importance of a coordinated internal and external corporate branding program and the inherent benefits of strategies that address not only the needs and wants of the stakeholders, but the proper hiring, placement, training, and motivation of employees who must deliver the corporate brand’s promise. Management should be responsible for corporate brand training and education, that is, recruiting, training, motivating, rewarding and providing equipment and technology.

For instance, regular brand training sessions, a brand-based intranet site, internal publications, a speaker series, and even periodical corporate brand promise reminders on the start-up screens of employees’ computers and Hallmark conducting periodical internal assessments of employees’ perceptions of the corporate brand with the intent of focusing on closing the gaps...
between internal and external stakeholder perceptions (Davis, 2000). The assumption that internal branding could shape employees' behaviour is largely based on the assumption that when employees understand and are committed to corporate brand values; they will perform in ways that live up to stakeholders' brand expectations.

2.4 Brand Asset Management
The Brand Asset Management process involves four phases and eleven steps. The first phase is to develop a brand vision. It consists of a single step: developing the elements of a brand vision. The basic objective of this step is to clearly state what the branding efforts must do to meet corporate goals. The second phase is to determine the organisation's “Brand Picture” by understanding consumer perceptions about the brand and that of competitor brands. This phase consists of three steps: determining the brand’s image, creating the brand’s contract - list of customer’s perceptions of all the current promises the brand makes-, and crafting a brand-based customer model. This allows for understanding how consumers act and think, and how and why they make their decisions. The third phase is to develop a brand asset management strategy, in order to determine the correct strategies for achieving goals according to the brand vision. This phase consists of five steps: positioning the brand, extending the brand, communicating the brand’s positioning, leveraging the brand, and pricing the brand. Finally, the fourth phase is to support a brand asset management culture. This final phase consists of two steps: creating a measure of the return on brand investment, and establishing a brand-based culture.

2.5 Critique of Existing Literature and Research Gaps
Corporate branding has been criticized as drawing on the traditions of product branding in that it shares the same objective of creating differentiation and preference. However, this activity is rendered more complex by managers conducting these practices at the level of the organisation and the requirement to manage interactions with multiple stakeholder audiences. Branding literature indicates that there is support for an increasing focus on the role of the organisation as a strategic element in the branding process (Abratt & Mofokeng, 2001).

It also highlights some of the problems inherent in managing a wider set of variables associated with the organisation. Despite a growing consensus about the benefits of corporate brand management (Fombrun & Rindova, 2008; Greyser, 2009), there remains considerable uncertainty over what this means in terms of management practices and the study of this emerging phenomenon.

Keller (2000) comments that many organisations are unsure what they should do to manage their corporate brand, whilst Balmer (1998, 2001) highlights the current confusion in the existing literature and stresses the need to understand the disciplines involved in managing and developing a corporate brand. Connected to this, there is failure to identify corporate branding elements and how these elements are managed (Balmer, 2001).

Many approaches in existing literature measure corporate reputation by overly focusing on the financial performance of organisations and on the views of external stakeholders. Further, there is as yet no established universal measure to assess both the internal i.e. identity and external i.e. image elements of corporate reputation and recognition. This suggests that there is a clear need to establish a new agenda and set of practices for corporate brand management at an organisational level.

Corporate branding necessitates a different management approach. It requires greater emphasis on branding strategies including factors internal to the organisation, paying greater attention to the role of employees in the brand building process. Corporate branding also requires a holistic approach to brand management, in which all members of an organisation behave in accordance with the desired brand identity.

There are limitations to the scope of the work conducted to date and gaps in previous research carried out. These limitations can be attributed to the refinement and extension of the corporate branding concept. Because of the dynamism of Corporate Branding, needs have not been well mapped in previous researches. Initial conceptual work has focused on defining corporate brands against product brands and identifying key determinants in the corporate branding process (Harris & De Chernatony, 2001).

The initial attention to the value and antecedents of strong corporate brands has been extended to investigate in more depth the roles played by corporate identity, corporate personality, corporate culture, employees, leadership, among others, in the corporate branding process. This evolution of thinking can be witnessed in corporate branding papers of seven past special issues on Corporate identity and corporate marketing (Balmer, 2001), Corporate and service brands (Balmer & Gray, 2003). Corporate marketing (2006), Brand management (Davies, 2008), perspectives on corporate and organisational marketing (Balmer, & Greyser, 2011). Yet, despite the increasing interest in corporate branding, an examination of the literature suggests that gaps on important issues in this debate remain largely unexplored.

The first and most significant research gap is the lack of conceptual clarity, which has been shown by (Balmer, 2001). First the use of terminology is not always clear; reputation, image, branding, and identity being used somewhat interchangeably, as near substitutes when they should not be. The precise meaning of many terms remains largely undefined and there is clearly no real consensus on what they mean (Balmer, 2001) who provided a set of conceptual definitions for all constructs in the domain.

The second research gap relates to the basic premise of how we conceptualise corporate brands; which, inevitably, influences how we manage corporate brands. Traditionally, normative approaches to corporate branding have seen corporate brands as created

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and managed by senior management (Balmer, 2001). However, more recently, social constructionist approaches argue for corporate brands as vehicles of meaning that emerge from social interaction between the organisation and its environment (Leitch & Richardson, 2003).

To date, these two perspectives have been positioned as alternative approaches to corporate branding. Further progress in corporate branding research should be driven by an understanding of the two perspectives. The third research gap is related to an absence of research on senior managers’ recognition of corporate brand building as a key corporate brand-building/management trait and the fit or alignment between the organisation and stakeholders’ perspectives is an important theoretical proposition in corporate branding theory. Fourth research gap is related to tension, whether corporate brands need to be studied and managed at the organisational (management) or individual (employee) level.

Corporate branding research has traditionally focused on organisational practices that aim to develop and manage corporate brands (Balmer & Gray, 2003). However, if we consider corporate brands as broad concepts, focusing on the individual level (how employees experience, interpret and influence corporate brands) could bring valuable insights (Motion et al., 2003). There is, hence, a need for future studies to capture corporate branding across multiple levels of analysis.

3. RESEARCH METHODOLOGY

The study adopted a descriptive research approach where questionnaires were sent to every department whose operations are based in Kenya under the European Union. Descriptive research design was chosen because it enabled the researcher generalise the findings to a larger population and allowed for investigation of the research questions in realistic settings due to its convenience and accuracy, especially in data collection and analysis. The cost in this approach was reasonable considering the amount of information gathered. Descriptive research analysed the relations of variables under study using linear regression which revealed and measured the strength of the target group’s opinion, attitude or behaviour with regards to improving the recognition of the EU corporate brand in Kenya. It also allowed greater flexibility in terms of money and time as well as avoiding the need for hunting for respondents more than once to produce a high response rate. These reasons justified the use of descriptive design and therefore generalised the findings to the EU corporate brand in Kenya.

The unit of analysis comprised and focused on the European Union Missions in Kenya. Currently there are five (5) active European Union operations in Kenya as per table 3.1. The unit of observation for this study constituted two hundred employees from these operations in Nairobi, as per table 3.1.

Table 3.1: Study Population

<table>
<thead>
<tr>
<th>No</th>
<th>Organisation</th>
<th>Location</th>
<th>No. of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kenya Missions</td>
<td>Upper Hill, Nairobi</td>
<td>69</td>
</tr>
<tr>
<td>2</td>
<td>EIB</td>
<td>Upper Hill, Nairobi</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>ECHO Nairobi</td>
<td>Upper Hill, Nairobi</td>
<td>47</td>
</tr>
<tr>
<td>4</td>
<td>EU CAP NESTOR</td>
<td>Upper Hill, Nairobi</td>
<td>31</td>
</tr>
<tr>
<td>5</td>
<td>Somalia Missions</td>
<td>Upper Hill, Nairobi</td>
<td>34</td>
</tr>
<tr>
<td>6</td>
<td>EU NAVFOR</td>
<td>Mombasa</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>EUTM</td>
<td>Mombasa</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>EUSR</td>
<td>Upper Hill, Nairobi</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>200</strong></td>
</tr>
</tbody>
</table>

Source: EU Missions Kenya 2015

The researcher stratified the population based on the number of operations and then, at 23% per strata, the researcher, randomly picked the samples. The sample was chosen from employees from European Union in Kenya. A carefully selected sample provided data representative of the population from which it was drawn. Sufficient sample size is the minimum number of participants required to identify a statistically significant difference, relationship or interaction. At least 30% of the total population is representative (Borg & Gall, 2003). The main factor considered in determining the sample size is the need to keep it manageable enough (Kothari, 2009).

The sample was selected on the basis of non-probability sample technique because the procedures that were used to select units for inclusion in a sample were much easier, less time consuming and cheaper. The unit of analysis in this study included these operations where convenience sampling was used. The units that were selected for inclusion in the sample were the easiest to access. The unit of observation was the individual staff members accessed in these operations. The researcher stratified the population based on the number of European Union operations and missions in Kenya; Kenya Missions, the European Investment Bank, Somalia Missions, European Commission Humanitarian Office (ECHO), European Union Naval Force (EU NAVFOR), EU Special Representative for Horn of Africa (EU SR), EU Training Mission (EUTM) and European Union Mission on Regional Maritime Capacity Building (EUCAP NESTOR Mission) which all have a total of two hundred (200) employees.

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The researcher then, at 66% per strata, randomly picked the samples. By selecting this sample size, the accuracy level of the information required was sufficiently met, the study sample was representative and had characteristics of the population and the value of the information in the study was also achieved. It also allowed the results to be generalised to the larger population and statistical analysis performed. To calculate the sample size based on the sample required to estimate a proportion with an approximate 95% interval level, Slovin’s formula was used.

\[ n = \frac{N}{1 + Ne^2} \]

Where \( n \) = sample size
\( N \) = population size
\( e \) = margin of error (5%)

Table 3. 2: Target Population

<table>
<thead>
<tr>
<th>No</th>
<th>Organisation</th>
<th>No. of Employees per Department</th>
<th>No. Of Employees</th>
<th>Sample Size (66%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kenya Missions</td>
<td>69</td>
<td>69</td>
<td>46</td>
</tr>
<tr>
<td>2</td>
<td>EIB</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>ECHO Nairobi</td>
<td>47</td>
<td>47</td>
<td>31</td>
</tr>
<tr>
<td>4</td>
<td>EU CAP NESTOR</td>
<td>31</td>
<td>31</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>Somalia Missions</td>
<td>34</td>
<td>34</td>
<td>22</td>
</tr>
<tr>
<td>6</td>
<td>EU NAVFOR</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>EUTM</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>EUSR</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>200</td>
<td></td>
<td>133</td>
</tr>
</tbody>
</table>

Source: EU Missions Kenya 2015

The study employed Simple Random Sampling technique. Simple Random sample is a subset of individuals, that is, sample, chosen from a larger set, that is, population. In this method, each individual was chosen entirely by chance and as such had the same probability of being selected as part of the sample. This method of sampling is an unbiased technique and is important because the average sample accurately represented the population. It allowed drawing of external valid conclusions about the entire population. The researcher selected this sampling technique because of the ease of assembling the sample and it is also a fair way of selecting a sample from a given population since every individual was given equal chances of being selected and was representative of the population (Yates, 2008). The method is free from bias and prejudice, convenient and simple to use and sampling error is easy to assess. This sampling technique was best suited as data collection was efficiently conducted on randomly distributed questionnaires and the cost was also small enough.

Primary data was collected through the use of questionnaires. Questionnaires helped gather information on knowledge, attitudes, opinions, behaviours, facts and other information. A questionnaire is a set of questions that have been prepared to ask a number of questions and collect answers from respondents relating to the research topics. The questions were in printed or were in electronic form. The questionnaires consisted of close ended and open ended questions. Closed ended questions provided alternative answers for the respondents to choose from and facilitate easier analysis as they were in immediate usable form. The open ended questions were used to encourage the respondent to provide in-depth and felt responses and solicited for additional information from the respondents. The questionnaire comprised of two sections which were created using suitable questions modified from related research and individual questions formed by the researcher. The questionnaires were accompanied by a brief introduction and purpose of the research. The researcher emailed the questionnaires to the respondents as most of the respondents have access to the electronic mail. Participants were given time to respond after which the questionnaires were sent back to the researcher through electronic mail.

A total of thirteen (13) questionnaires were distributed randomly among employees from 3 European Union operations. This process helped refine the questionnaire, enhance its legibility and minimized the chances of misinterpretation, such as misleading questions that could have potentially resulted in invalid responses. Before the actual study, the instruments were discussed with the supervisors. The feedback from the supervisors helped in modifying the instrument. The pilot study allowed for pre-testing of the research instrument. The clarity of the instrument items to the respondents was necessary so as to enhance the instrument’s validity and reliability. Test re-test method was used to pilot the questionnaires, which do not form sample of the study. Reliability was calculated with the help of Statistical Package for Social Sciences (SPSS). A correlation coefficient greater or equal to 0.6 was accepted (George & Mallery, 2003).
The researcher used qualitative research approach. Qualitative research is designed to address questions of meaning, interpretation and socially constructed realities (Newman et al., 2003). The researcher used the statistical Package for Social Sciences (SPSS version 21) computer program to facilitate addressing the research objectives. Quantitative data was summarised using descriptive statistics which included mean, mode, standard deviations, frequencies and percentages. Regression analysis was prepared to determine the effect of branding strategies on corporate brand recognition at the European Union Missions in Kenya. Relationship between variables was determined using the multiple regression model conceptualized as shown below:

\[ y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \beta_4 x_{i4} + \epsilon_i \]

Where \( y_i \) is the dependent variable (Corporate brand recognition), \( x_{ij} \) is the \( j \)th observation on the \( j \)th independent variable, and where the first independent variable takes the value 1 for all \( i \) (so \( \beta_0 \) is the regression intercept), and \( \epsilon_i \) is the error in the \( i \)th observation.

4.1.2 Descriptive Statistics

Descriptive data is used to give a general overview of the data. The respondents were asked to rate, using a likert scale ranging from 1 to 5 (Where 1- strongly agree, 2- Agree, 3-Strongly disagree, 4-Disagree, 5-Neither Agree nor Disagree. The results are presented in table 4.4 along with standard deviations. The ratings ranged from 1 to 5). The ratings ranged from 1 to 5 (Where 1- strongly agree, 2- Agree, 3-Strongly disagree, 4-Disagree, 5-Neither Agree nor Disagree. The results are presented in Table 4.4 along with standard deviations.

### Table 4.1: Summary statistics for main variables

<table>
<thead>
<tr>
<th>Main Variable</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Social Responsibility</td>
<td>133</td>
<td>2.339</td>
<td>0.878</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Brand Communities</td>
<td>133</td>
<td>1.820</td>
<td>0.617</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Internal Branding</td>
<td>133</td>
<td>1.626</td>
<td>0.553</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Brand Asset Management</td>
<td>133</td>
<td>1.775</td>
<td>0.660</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Corporate Brand Recognition</td>
<td>133</td>
<td>1.923</td>
<td>0.587</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

4.1.2.1 Information on Corporate Social Responsibility Strategy

This section analyses the questions addressed to respondents in relation to corporate social responsibility strategy. The questions in an elaborate way established the effect of corporate social responsibility strategy on recognition of corporate brand at European Union in Kenya. Table 4.2 illustrates the survey results on corporate social responsibility branding strategy.

### Table 4.2: Information on Corporate Social Responsibility Strategy

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>SD</th>
<th>D</th>
<th>NA/D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporations already invest in both branding and philanthropy, the rationale for integrating branding and CSR derives from the synergies created when both strategies merge</td>
<td>5%</td>
<td>5%</td>
<td>1%</td>
<td>36%</td>
<td>54%</td>
<td>100%</td>
</tr>
</tbody>
</table>
CSR Governance Structure is a collaborative scheme, which involves a partnership between the firm and an organisation in which the firm transfers resources to the Organisation in order to carry out CSR activities jointly.

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>SD</th>
<th>D</th>
<th>NA/D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSR is a legitimisation ethics and gives an instrumental perspective where Corporate Image is the prime concern</td>
<td>51%</td>
<td>30%</td>
<td>4%</td>
<td>0%</td>
<td>16%</td>
<td>100%</td>
</tr>
<tr>
<td>EU branded CSR has turned philanthropy from implicit delivery of the promise to an explicit one</td>
<td>41%</td>
<td>29%</td>
<td>4%</td>
<td>17%</td>
<td>9%</td>
<td>100%</td>
</tr>
<tr>
<td>EU as a brand through CSR has continuously been giving back to society</td>
<td>43%</td>
<td>49%</td>
<td>8%</td>
<td>1%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>EU considers CSR as one of the suitable ways that should be applied in its operations.</td>
<td>43%</td>
<td>29%</td>
<td>5%</td>
<td>0%</td>
<td>23%</td>
<td>100%</td>
</tr>
<tr>
<td>CSR helps EU effectively deal with risks caused by social pressures and pressures from benefit groups</td>
<td>43%</td>
<td>58%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>EU conducts CSR activities geared towards brand/visibility regularly</td>
<td>37%</td>
<td>30%</td>
<td>6%</td>
<td>0%</td>
<td>27%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The respondents were asked whether Corporations already invest in both branding and philanthropy, the rationale for integrating branding and CSR derives from the synergies created when both strategies merge. 54% of the respondents were neutral, 36% disagreed, with 10% of the respondents agreeing and a paltry 1% of the respondents strongly disagreeing about the matter. On whether CSR Governance Structure is a collaborative scheme, which involves a partnership between the firm and an organisation in which the firm transfers resources to the Organisation in order to carry out CSR activities jointly, 79% of the respondents were in agreement whereas 17% were in disagreement with a paltry 4% being neutral.

On whether CSR is a legitimisation ethics and gives an instrumental perspective where Corporate Image is the prime concern, 81% of the respondents were in agreement with 4% being in disagreement and a paltry 4% being neutral. On whether EU branded CSR has turned philanthropy from implicit delivery of the promise to an explicit one, 70% of the respondents were in agreement with 21% disagreeing. On whether EU as a brand through CSR has continuously been giving back to society, 92% of the respondents were in agreement with 8% disagreeing. On whether EU considers CSR as one of the suitable ways that should be applied in its operations, 72% of the respondents were in agreement with 5% being in disagreement and 23% being neutral. On whether EU as a brand through CSR has continuously been giving back to society, 100% of the respondents were in agreement. On whether EU conducts CSR activities geared towards brand/visibility regularly, 67% of the respondents were in agreement with 6% disagreeing and 2% being neutral.

4.1.3 Information on Brand Communities Strategy

The study sought to establish the effect of brand communities’ strategy on recognition of corporate brand at European Union Missions in Kenya, the respondents were asked whether Brand communities participate in the brand’s larger social construction and play a vital role in the brand’s ultimate legacy. Table 4.3 illustrates information on Brand Communities.

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>SD</th>
<th>D</th>
<th>NA/D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand communities participate in the brand’s larger social construction and play a vital role in the brand’s ultimate legacy</td>
<td>45%</td>
<td>55%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Brand communities can strengthen brand equity, while also reinforcing the social nature of Brands.</td>
<td>35%</td>
<td>55%</td>
<td>0%</td>
<td>5%</td>
<td>5%</td>
<td>100%</td>
</tr>
<tr>
<td>Brand communities carry out important functions on behalf of the brand, e.g. sharing information, perpetuating the history and culture of the brand</td>
<td>37%</td>
<td>40%</td>
<td>0%</td>
<td>0%</td>
<td>23%</td>
<td>100%</td>
</tr>
<tr>
<td>They provide social structure to the relationship between employee and stakeholder</td>
<td>36%</td>
<td>56%</td>
<td>8%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Brand communities have a common understanding of a shared identity of the EU brand</td>
<td>26%</td>
<td>60%</td>
<td>4%</td>
<td>0%</td>
<td>10%</td>
<td>100%</td>
</tr>
</tbody>
</table>
EU has demonstrated a growing response about how its brand is perceived  
40%  52%  1%  4%  3%  100%

EU continuously expresses its identity through multiple channels to brand communities  
45%  52%  0%  0%  3%  100%

EU understands and communicates its corporate branding strategies  
48%  52%  0%  0%  0%  100%

Majority of the respondents (100%) were in agreement. On whether Brand communities can strengthen brand equity, while also reinforcing the social nature of Brands, 90% of the respondents were in agreement with a paltry 5% being in disagreement. On whether Brand communities carry out important functions on behalf of the brand, e.g. sharing information, perpetuating the history and culture of the brand, 77% of the respondents were in agreement with 23% of the respondents being neutral. On whether Brand communities provide social structure to the relationship between employee and stakeholder, 92% of the respondents were in agreement with 8% being in disagreement.

On whether Brand communities have a common understanding of a shared identity of the EU brand, 86% of the respondents were in agreement with 4% being in disagreement. On whether EU has demonstrated a growing response about how its brand is perceived, 93% of the respondents were in agreement while 3% of the respondents were neutral. On whether EU continuously expresses its identity through multiple channels to brand communities, 97% of the respondents were in agreement while 3% of the respondents were neutral. On whether EU understands and communicates its corporate branding strategies, majority of the respondents (100%) were in agreement.

4.1.4 Information on Internal Branding Strategy

In relation to internal branding strategy, the respondents were asked to establish the effect of Internal Branding strategy on recognition of corporate brand at European Union Missions in Kenya. Table 4.4 illustrates information on Internal Branding Strategy.

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>SD</th>
<th>D</th>
<th>NA/D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal branding is an enabler of EU’s success in delivering the brand promise to stakeholders</td>
<td>58%</td>
<td>41%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Internal branding assists EU in promoting the corporate brand to employees</td>
<td>16%</td>
<td>79%</td>
<td>4%</td>
<td>0%</td>
<td>1%</td>
<td>100%</td>
</tr>
<tr>
<td>Internal branding contributes in aligning EUs internal processes and corporate culture with those of the desired brand</td>
<td>63%</td>
<td>32%</td>
<td>0%</td>
<td>3%</td>
<td>2%</td>
<td>100%</td>
</tr>
<tr>
<td>EU internal branding portrays a consistent and continuous identity that is trusted</td>
<td>57%</td>
<td>40%</td>
<td>0%</td>
<td>0%</td>
<td>4%</td>
<td>100%</td>
</tr>
<tr>
<td>EU as a strong brand has been found to be instrumental in the facilitation of improved brand loyalty and greater stakeholder value</td>
<td>39%</td>
<td>52%</td>
<td>4%</td>
<td>2%</td>
<td>4%</td>
<td>100%</td>
</tr>
<tr>
<td>Employees who are in consensus with EU brand are more likely to act consistently in ways supporting how the EU hopes that external stakeholders perceive it</td>
<td>81%</td>
<td>9%</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>100%</td>
</tr>
<tr>
<td>EU engages itself in activities to set up the stakeholders’ perception</td>
<td>47%</td>
<td>46%</td>
<td>0%</td>
<td>0%</td>
<td>8%</td>
<td>100%</td>
</tr>
<tr>
<td>Internal branding stresses the importance of a coordinated internal and external corporate branding program</td>
<td>55%</td>
<td>41%</td>
<td>0%</td>
<td>0%</td>
<td>4%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The respondents were asked whether internal branding is an enabler to EU’s success in delivering the brand promise to stakeholders. Majority (100%) of the respondents were in agreement. On whether internal branding contributes in aligning EUs internal processes and corporate culture with those of the desired brand, 95% of the respondents were in agreement while 3% disagreed and 2% were neutral. On whether EU internal branding portrays a consistent and continuous identity that is trusted, 96% of the respondents were in agreement while 4% were neutral.

On whether EU as a strong brand has been found to be instrumental in the facilitation of improved brand loyalty and greater stakeholder value, 91% of the respondents were in agreement while 6% were in disagreement with 3% being neutral. On whether Employees who are in consensus with EU brand are more likely to act consistently in ways supporting how the EU hopes that...
external stakeholders perceive it, 90% of the respondents were in agreement while 10% were neutral. On whether EU engages itself in activities to set up the stakeholders’ perception, 93% of the respondents were in agreement while 8% were neutral on the matter. On whether internal branding stresses the importance of a coordinated internal and external corporate branding program, 96% of the respondents were in agreement while 4% were neutral on the matter.

4.1.5 Information on Brand Asset Management Strategy

In relation to the using a likert scale ranging from 1 to 5, the respondents were asked to indicate effect of brand assessment management strategy on recognition of corporate brand at European Union Missions in Kenya. Table 4.5 shows information on brand asset management strategy.

Table 4.5: Information on Brand Asset Management Strategy

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>SD</th>
<th>D</th>
<th>NA/D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand asset management is a balanced investment approach for building and communicating the meaning of the brand, internally and externally</td>
<td>34%</td>
<td>62%</td>
<td>0%</td>
<td>0%</td>
<td>4%</td>
<td>100%</td>
</tr>
<tr>
<td>Brands and people are an organisation’s most valuable asset</td>
<td>51%</td>
<td>47%</td>
<td>0%</td>
<td>0%</td>
<td>2%</td>
<td>100%</td>
</tr>
<tr>
<td>Brand asset management at EU involves every functional area</td>
<td>52%</td>
<td>20%</td>
<td>0%</td>
<td>2%</td>
<td>27%</td>
<td>100%</td>
</tr>
<tr>
<td>EU brand asset management clearly states branding efforts employees must make to meet corporate goals</td>
<td>40%</td>
<td>56%</td>
<td>0%</td>
<td>1%</td>
<td>4%</td>
<td>100%</td>
</tr>
<tr>
<td>EU understands employee and stakeholder perceptions about the brand through brand asset management</td>
<td>35%</td>
<td>36%</td>
<td>0%</td>
<td>22%</td>
<td>7%</td>
<td>100%</td>
</tr>
<tr>
<td>Brand asset management involves brand vision, picture, image and brand asset management culture</td>
<td>52%</td>
<td>43%</td>
<td>0%</td>
<td>0%</td>
<td>5%</td>
<td>100%</td>
</tr>
<tr>
<td>EU has developed a brand asset management strategy towards achieving its brand vision goals</td>
<td>58%</td>
<td>39%</td>
<td>4%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>EU management supports a brand asset management culture</td>
<td>63%</td>
<td>22%</td>
<td>0%</td>
<td>8%</td>
<td>7%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The respondents were asked whether Brand asset management is a balanced investment approach for building and communicating the meaning of the brand, internally and externally. 96% of the respondents were in agreement while 4% were neutral about the matter.

On whether brands and people are an organisation’s most valuable asset, 98% of the respondents were in agreement while 2% were neutral about the matter. On whether brand asset management at EU involves every functional area, 72% of the respondents were in agreement while 2% of were in disagreement with 27% being neutral. On whether EU brand asset management clearly states branding efforts employees must make to meet corporate goals, 96% of the respondents were in agreement while 1% was in disagreement with 3% being neutral about the matter.

On whether EU understands employee and stakeholder perceptions about the brand through brand asset management, 71% of the respondents were in agreement while 22% were in disagreement with 7% being neutral about the matter. On whether Brand asset management involves brand vision, picture, image and brand asset management culture, 96% of the respondents were in agreement while 5% were neutral about the matter. On whether EU has developed a brand asset management strategy towards achieving its brand vision goals, 96% of the respondents were in agreement while 4% were in disagreement about the matter. On whether EU management supports a brand asset management culture, 5% of the respondents were in agreement while 8% were in disagreement with 7% being in disagreement.

4.1.6 Information on Corporate Brand Recognition Strategy

Table 4.6: Information on Corporate Brand Recognition Strategy

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>SD</th>
<th>D</th>
<th>NA/D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Brands are cultural, as they reflect the organisation's sub-cultures</td>
<td>40%</td>
<td>60%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Corporate brand recognition manifests emotional responses from stakeholder groups and the need for total commitment across the organisation.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agreement (%)</th>
<th>Disagreement (%)</th>
<th>Neutral (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyone in the Organisation should be responsible for the Corporate Brand recognition and its maintenance</td>
<td>27%</td>
<td>21%</td>
<td>52%</td>
</tr>
<tr>
<td>Corporate Brand recognition requires constant support, commitment and attention from the top management at large</td>
<td>75%</td>
<td>25%</td>
<td>0%</td>
</tr>
<tr>
<td>Corporate brand recognition responds to the expectations of multiple stakeholders, e.g. internal stakeholders, external stakeholders and networks</td>
<td>25%</td>
<td>52%</td>
<td>0%</td>
</tr>
<tr>
<td>All employees represent the Corporate Brand and affect the perceptions of the external stakeholders</td>
<td>69%</td>
<td>25%</td>
<td>4%</td>
</tr>
<tr>
<td>In corporate brand recognition, the relationship between the stakeholder and the organisation is more important</td>
<td>21%</td>
<td>72%</td>
<td>0%</td>
</tr>
<tr>
<td>Values of the Corporate Brand have to resonate with the unspoken meanings and values that employees hold and use</td>
<td>48%</td>
<td>35%</td>
<td>17%</td>
</tr>
</tbody>
</table>

As illustrated in table 4.6, the survey results indicated that corporate brands are cultural, as they reflect the organisation's sub-cultures with 100% of the respondents being in agreement. In terms of corporate brand recognition manifests emotional responses from stakeholder groups and the need for total commitment across the organisation, 96% of the respondents were in agreement while 4% of the respondents were in disagreement. In terms of everyone in the Organisation being responsible for the corporate brand recognition and its maintenance, 48% of the respondents were in agreement while 12% were in disagreement with 40% being neutral.

In terms of corporate brand recognition requiring constant support, commitment and attention from the top management at large, all the respondents were in agreement. In terms of corporate brand recognition responding to the expectations of multiple stakeholders, e.g. internal stakeholders, external stakeholders and networks, 76% of the respondents were in agreement while 8% were in disagreement with 16% being neutral. In terms of all employees representing the corporate brand and affecting the perceptions of the external stakeholders, 93% of the respondents were in agreement while 4% were in disagreement with 3% being neutral. In terms of corporate brand recognition, the relationship between the stakeholder and the organisation being more important, 93% of the respondents were in agreement while 7% were neutral. In terms of values of the Corporate Brand resonating with the unspoken meanings and values that employees hold and use, 83% of the respondents were in agreement while 17% were neutral.

4.1.7 Model Fit

Multiple regression analysis results were carried out to determine the relationship between the dependent variables and independent variables. The dependent variable in this case was corporate brand recognition while the independent variables were corporate social responsibility, brand communities, internal branding and brand asset management.

<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>0.754</td>
<td>0.569</td>
<td>0.556</td>
<td>0.462</td>
</tr>
</tbody>
</table>

Table 4.7 illustrates the results for variations between the dependent and the independent variables. The correlation coefficient R = 0.754 indicates that the dependent variable i.e. Corporate Brand Recognition and independent variables i.e. Corporate Social Responsibility, Brand Communities, Internal Branding, Brand Asset Management have a moderate degree of correlation. The (R Squared) value of about 0.569 indicates that 56.9% of the variation in corporate brand recognition was explained by corporate social responsibility, brand communities, internal branding and brand asset management strategies.

The adjusted coefficient of determination (Adj R Squared) was less than the unadjusted Coefficient of determination as it should always be (Adj R Squared=0.569 < R Squared = 0.556). This still implied that 55.6% of the variation in corporate brand
recognition was explained by corporate social responsibility, brand communities, internal branding and brand asset management strategies.

Table 4.8: Analysis of Variance Test Results

<table>
<thead>
<tr>
<th>Item</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>36.400</td>
<td>4</td>
<td>9.100</td>
<td>42.578</td>
<td>.000b</td>
</tr>
<tr>
<td>Residual</td>
<td>27.571</td>
<td>129</td>
<td>.214</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>63.970</td>
<td>133</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The result predicts the dependent variable by showing how well the regression equation fits the model. The significance value P = 0.00 of the regression model was less than the level of significance of 0.01 at 95% confidence level. This indicates that the overall regression model statistically significantly corporate brand recognition at European Union Missions in Kenya and supports the notion that there exists a strong positive relationship between the study variables.

The multiple regression model with corporate brand recognition as the dependent variable and corporate social responsibility, brand communities, internal branding and brand asset management strategies as independent variables was estimated in the study. The standardised Beta coefficients were considered because the raw units of the dependent and independent variables are not generally familiar in terms of commonly used standardised units of measurement such as income, years, currency among others. The standardised Beta coefficients are convenient since they represent the dependent and independent variables in terms of t scores such that the information is conveyed in terms of standard deviation and hence the question of strength of association relative to the variation in this distribution is answered.

4.1.8 Distribution of Coefficients

The table of coefficients below measures individual relationship between the various variables (branding strategies) and corporate brand recognition. The table shows the coefficients Betas for each of the predictor and its values indicate the individual contribution of each predictor to the model. Table 4.9 illustrates the distribution of coefficients.

Table 4.9: Distribution of coefficients

<table>
<thead>
<tr>
<th>Items</th>
<th>Standardised Coefficients</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>t</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>3.791</td>
</tr>
<tr>
<td>Corporate Social Responsibility Strategy</td>
<td>.676</td>
<td>10.243</td>
</tr>
<tr>
<td>Brand Communities Strategy</td>
<td>-.250</td>
<td>-3.324</td>
</tr>
<tr>
<td>Internal Branding Strategy</td>
<td>-.037</td>
<td>-3.86</td>
</tr>
<tr>
<td>Brand Asset Management Strategy</td>
<td>.391</td>
<td>4.349</td>
</tr>
</tbody>
</table>

Note: The significance testing hypothesis accept p<0.05, value P = 0.00

From the regression model, the following regression equation was derived:

\[ Y = 0.679 x_{i1} - 2.50 x_{i2} - 0.037 x_{i3} + 0.391 x_{i4} + \varepsilon \]

Where,

- \( y_i \) = Effect of Corporate brand recognition
- \( x_{i1} \) = Effect Corporate Social Responsibility
- \( x_{i2} \) = Effect Brand Communities
- \( x_{i3} \) = Internal Branding
- \( x_{i4} \) = Brand Asset Management
- \( \varepsilon \) = Error Term.

The regression results based on the beta coefficients from the above regression model indicated that; corporate social responsibility strategy has a positive effect on corporate brand recognition and improves it by 0.676 standardized coefficients. Brand communities strategy and internal branding strategy had a negative effect on corporate brand recognition reducing it by 0.250 standard deviations and 0.307 standard deviations respectively. Brand asset management strategy was observed to have a positive effect on corporate brand recognition improving it by 0.391 standard deviations.
4.2 Summary of the Findings
The number of respondents of the study was 133 with a sampling rate of 100% from European Union Missions operations and missions in Kenya. To ensure the collection of rich information, the study focused on respondents from different age brackets and who were from different operations with different years of service from the European Union Missions operations and missions in Kenya.

On the first specific objective, the study was to determine the effect of corporate social responsibility on corporate brand recognition at European Union Missions of Kenya. The results indicated that few respondents strongly disagreed with the information provided indicating that corporate social responsibility (0.676) had a positive effect on corporate brand recognition at European Union Missions of Kenya. The finding was established to be consistent with Bevan et al., (2004); Schaltegger & Burritt, (2005); Weber, (2008) and Cheng & Ahmad, (2010).

On the second specific objective, the study was to establish the effect of brand communities on corporate brand recognition at European Union Missions of Kenya. The study measured how the respondents rated the list of information on brand communities’ strategy presented by strongly agreeing, agreeing, strongly disagreeing or neither agreeing nor disagreeing. The results indicated that some of the respondents strongly disagreed with the information provided. Brand communities strategy had a negative effect on corporate brand recognition at Beta= -.250, t= -3.324, significance 0.001. This means that brand communities strategy negatively affected corporate brand recognition showing that the result was inconsistent with Dacin & Brown, (2006), and Schultz, Hatch & Larsen, (2000).

On the third specific objective, the study was to determine the effect of internal branding strategy on corporate brand recognition at European Union Missions of Kenya. The results indicated that some of the respondents disagreed with the information provided indicating that internal branding strategy had a negative effect on corporate brand recognition at Beta= -0.37, t= -3.386, significance .007. Most respondents strongly agree that employees who are in consensus with EU brand are more likely to act consistently in ways supporting the EU hopes that the external stakeholders perceive it. This means that internal branding strategy negatively influences corporate brand recognition showing that the result is inconsistent with Zeithaml et al., (2006); Hatch and Schultz (2001).

On the fourth specific objective, the study was to determine the effect of brand asset management strategy on corporate brand recognition at European Union Missions of Kenya. The study measured how the respondents rated the list of information on internal brand asset management strategy presented by strongly agreeing, agreeing, strongly disagreeing or neither agreeing nor disagreeing. The results indicated that few respondents strongly disagreed with the information provided indicating that brand asset management strategy had a positive effect on corporate brand recognition at Beta= .391, t= -3.386, significance .001. Most respondents strongly agree that the management should support a brand asset management culture. This means that brand asset management strategy positively influences corporate brand recognition showing that the results are consistent with Davis & Dunn (2002).

4.3 Conclusion
On the overall, the relationship between the four branding strategies and corporate brand recognition is statistically significant. In view of the findings, this study established that the effects of branding strategies on recognition of corporate brand at European Union Missions in Kenya. Strategies such as corporate social responsibility and brand asset management had a positive effect while internal branding and brand communities strategy had a negative effect on recognition of corporate brand at European Union Missions in Kenya.

Majority of respondents indicated that corporate social responsibility strategy had a positive effect on recognition of corporate brand at European Union Missions in Kenya. Corporate social responsibility strategy is a strong tool in improving recognition of corporate brand in terms of giving back to society, dealing with risks and brand visibility among others.

On brand communities’ strategy, most respondents indicated that it had a somewhat negative effect on recognition of corporate brand at European Union Missions in Kenya. Strategies which were identified to have a negative effect included carrying out important functions on behalf of the brand, strengthening brand equity, while also reinforcing the social nature of brands and having a common understanding of a shared identity of the EU brand among others.

On internal branding strategy, most respondents indicated that it had somewhat a negative effect on recognition of corporate brand at European Union Missions in Kenya. Strategies which were identified to have a negative effect included internal branding which assists EU in promoting the corporate brand to employees, internal branding which contributes in aligning EUs internal processes and corporate culture with those of the desired brand and EU engaging itself in activities to set up the stakeholders’ perception among others.

On brand asset management strategy, most respondents indicated that it had a positive effect on recognition of corporate brand at European Union Missions in Kenya. Strategies which were identified to have a positive effect included brand asset management at EU involving every functional area, EU understanding employee and stakeholder perceptions about the brand through brand
asset management, EU developing a brand asset management strategy towards achieving its brand vision goals and EU management supporting a brand asset management culture among others.

4.4 Recommendations
4.4.1 Policy Recommendations

Corporate social responsibility strategy should be regularly used especially in all EU operations in Kenya so as to continue enhancing the recognition of corporate brand at EU Missions in the country.

EU Missions operations in Kenya should focus on enhancing the use of brand communities’ strategies in all operations so as to improve the recognition of corporate brand in terms of carrying out important functions on behalf of the brand, strengthening brand equity, while also reinforcing the social nature of brands and having a common understanding of a shared identity of the EU brand among others.

Internal branding strategy at the EU Missions operation mission ought to be enhanced as well so as to improve its effect on the recognition of corporate brand in terms of promoting the corporate brand to employees, contributing and aligning EU’s internal processes and corporate culture with those of the desired brand, and EU engaging itself in activities to set up the stakeholders’ perception among others.

Brand asset management strategy which was identified to have a positive effect on the recognition of corporate brand at EU Missions operations in Kenya should continue to be enhanced and used within the organisation.

4.4.2 Recommendations for Further Research

The research gap of this study focused on four key areas which focused on how recognition of corporate brand within organisations may be improved. The study therefore proposes that future research should be carried out in the following key areas: To investigate the effect of brand communities strategies on recognition of corporate brand in organisations in Kenya; and to investigate the effect of internal branding strategies on the recognition of corporate brand in organisations in Kenya.

REFERENCES


Crowther David & Aras Güler (2008), Corporate Social Responsibility, Denmark, Ventus Publishing ApS.


Hatch, Mary Jo & Majken Schultz (2003), *“Bringing the Corporation into Corporate Branding”*, European Journal of Marketing, 37 (7/8), 1041-1064.


ENTREPRENEURIAL FACTORS INFLUENCING PERFORMANCE OF HORTICULTURAL EXPORTING YOUTH GROUPS IN KIRINYAGA COUNTY, KENYA

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Dr. Jane Omwenga

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Project Supervisor, Jomo Kenyatta University of Agriculture and Technology

ABSTRACT - The study sought to establish the entrepreneurial factors influencing performance of horticultural exporting youth groups in Kirinyaga county Kenya. The results were intended to increase our understanding on these entrepreneurial factors and provide an opportunity for implementation of the recommendations for future policy frameworks, tertiary and higher educational policies as well as future research and studies. The study employed stratified random sampling to collect data from 205 small scale horticulture farmers using questionnaires. The key factors that were identified for this study included four independent variables – business management skills, availability of funds, market availability and accessibility and technology adoption. These independent variables were tested against the dependant variable (performance of horticultural exporting youth groups). The data collected was analyzed using descriptive and inferential statistics through the use of questionnaires. The study established that lack of relevant training and knowledge, getting the initial capital for business start up, access to the market and technology adoption all remained the major limiting factors to the performance and success of horticulture farmers in Kirinyaga County. The study recommended that the government should start offering basic business and financial management skills as this will enable entrepreneurs to make informed investment decisions as well as enhance their entrepreneurial skills that enable them to recognize and exploit the available business opportunities.

Key Words: Technology Adoption, entrepreneurial factors, Performance

1. INTRODUCTION
The role and importance of small enterprise sector to economies of countries, especially developing economies has been recognized and documented in the entire world. This is mainly in terms of job creation, technological innovation and gross national product. The role of entrepreneurship in economic development involves more than just increasing per capita output and income; it involves initiating and constructing change in the structure of business and society. This change is accompanied by growth and increased output, which allows more wealth to be divided by various participants (Robert, Michael & Dean, 2009).

Entrepreneurship is about business start ups and growth. A business is like a person. It is conceived and developed in the mind and then born. It then grows and matures and can die. The future of entrepreneurship appears to be very bright. We are living in the age of entrepreneur, with entrepreneurship endorsed by educational institutions, government units, society and corporations. Governments are taking an increased interest in promoting the growth of entrepreneurship. Individuals and groups are encouraged to form new businesses and are provided with government support. But it has been observed that despite increased efforts by the government and other development partners in promoting entrepreneurship amongst youths; little or no growth has been realized especially in the horticulture sector (Bwisa, 2011) Past statistics indicate that three out of five businesses fail within the first few months of operation (Kenya National Bureau of Statistics, 2007).

The establishment and nurturing of SMEs is a vital ingredient in creating dynamic market economies in the economic and social development of transition countries. Entrepreneurs are the big drivers of economic growth, innovation, regional development and job creation. A strong and vibrant SME sector provides a strong foundation to increase standards of living and to reduce poverty. Despite the internationally recognized importance of SMEs, they still face major challenges in many developing and transition countries today. The challenges of business entry, survival and growth are often substantial (Stoke & Wilson, 2006).
Trade in fresh horticultural products has become increasingly global. The trade is vertically integrated through contracts rather than control and ownership of the means of production. This trend has been encouraged by a liberalizing international and national regulatory framework associated with World Trade Organization (WTO), International Monetary Fund (IMF) and the World Bank policies, and has been further facilitated by improvements in communication and packaging technologies. Others estimate that trade in fresh fruits, vegetables and cut flower is equivalent to 8 percent of global commodity trade-equivalent to that of crude petroleum (Bruinsma, 2008).

Horticultural crops development authority records that up to 80% of horticultural production in Kenya is under taken by smallholder farmers. The sub-sector employs approximately 4.5 million people countrywide directly in production, processing, and marketing; while another 3.5 million people benefit indirectly through trade and other activities (Horticultural crops Development Authority, 2005). The Government has therefore identified horticulture as a major sub-sector in realizing the country’s “Vision 2030” which envisages Kenya as middle income earner economy and semi-industrialized country. Despite their significant contribution, smallholder farmers in Kenya are facing a number of challenges including high cost of inputs, limited access to extension services, unreliable weather, and limited access to direct markets. In a bid to address these challenges, the Government is implementing either singly or with collaborating partners a number horticultural projects and programs with specific objectives (KDLC, 2010).

Horticulture farmers have increased their strength by forming associations. Kenya has in recent years witnessed a rapid growth in MSE associations. Despite this, the sector is still constrained in several ways. The formation of most groups is the outcome of external pressures of government policy, political interventionism and donor funding. Eg the Kenya government Uwezo fund created in 2013 requires the youth and women to form groups to access the funds. This top-down influence has dampened the self-help spirit and lowered the spirit of members ownership within the associations. The sector remains largely uncoordinated and the capacity of MSE associations to lobby for implementation of policies for MSE development remains weak. Weak and poorly organized associations that lack the bargaining power and advocacy capacity are largely to blame for limited participation of MSEs in planning their activities and general development (KIPPRA, 2003).

In a bid to address the above challenges, the Government continues formulating horticultural projects and programs with a view of addressing specific objectives; four such projects are the National Accelerated Agriculture Input Program (NAAIP), Njaa Marufuku programme, Smallholder Horticulture Marketing Project (SHoMAP), and the Smallholder Horticulture Development Project (SHDP). The NAAIP is involved in capacity building and provision of seed and fertilizer grants for one hectare per smallholder farmer. Among key priorities in the Kirinyaga County Development plan for the period (2013-2017) is enhancement of entrepreneurship through sensitization of indigenous entrepreneurs in processing, management and marketing. There is high concentration of stakeholders in Kirinyaga production area, which is equally very active in export horticulture business. This scenario is prevalent in the horticultural sector. The main objective was to explore entrepreneurial factors influencing performance of horticultural exporting youth groups in Kirinyaga County Kenya. Specific objectives were: to examine the effect of business management skills level on entrepreneurial performance of horticultural exporting youth groups in Kirinyaga county, to determine the effect of availability of funds on entrepreneurial performance of horticultural exporting youth groups in Kirinyaga county, to determine the effect of market availability and accessibility on entrepreneurial performance of horticultural exporting youth groups in Kirinyaga County and to determine the effect of technology adoption on entrepreneurial performance of horticultural exporting youth groups in Kirinyaga county.

2. LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Credit Rationing Theory

In their formulation, Stiglitz and Weiss (1981) argued that agency problems (a conflict of interest between management (agents) and the shareholders (owners) of the organization) and information asymmetries are the major reason why SMEs have constrained access to finance. SMEs know their real financial structure, the real strength of the investment project and the effective intention to repay the debt, that is, firms have superior private information (asymmetric information). Hence, the bank manager makes decisions under asymmetric information, and operates under a moral hazard and adverse selection risk.

Stiglitz and Weiss (1981) explained the choice among different financing sources under conditions of asymmetric information and credit rationing. Asymmetric information can lead to credit rationing conditions by modifying the risk-return distribution; this fact encourages banks to refuse capital for investments and produces divergence between capital demand and supply (Alfo & Trovato, 2006).

Start-up small firms are more likely to be affected by information asymmetry problems. There are some categories of SMEs that will face additional problems due to lack of security, such as young entrepreneurs or those from deprived areas. In addition, there may be asymmetries arising from location as well as sector. For example, owners of MSEs in rural environments may face difficulties with
access to bank finance. Small firms are more likely to be rationed because they are seen as particularly risky. Although they might be willing to pay more to compensate for the additional risk, the banks will refuse to raise the interest rate sufficiently to equate supply and demand.

### 2.1.2 Industrial Organizational Economics Theory

Different firms, and different industries, make different levels of profits. This is something neo-classical economics cannot explain. Industrial organization economics (IOE) is essentially based on the idea that excess profits (those above and beyond those necessary to keep a firm in business) arise due to market imperfections. Market imperfections occur when classical assumptions fail to occur. Important instances are when there are only a small number of suppliers, giving rise to monopoly, costs associated with entering and exiting a new market, economics of scale, and product differentiation and buyers substitution products from one industry with those of another.

The school has three main stages of development. The first stage, initiated largely by Brain (1968) suggests that firms strive for monopolistic power to protect market positions and collect large rents. They attempt to restrain output and competition so that they may charge higher prices or reduce the quality of the product. The second stage is associated with the work of Porter (1980, 1985). Porter inverted Brain's idea. Rather than firms finding themselves in a structured position and then having to adjust their conduct to improve performance, Porter suggested that managers might actively seek out unexploited structures (market positions) that, given current conduct, or conduct that might be developed, would lead to superior performance. Porter’s central suggestion is the idea of ‘five forces’. The third stage in the development of IOE reflects a change in both perspective and methodology. The change in perspective has been from the (implicit) assumption of the static, given nature of structural market imperfections that surrounds a firm or sector to a recognition that such imperfections are dynamic and result from interacting decision making by competitors, buyers and suppliers.

### 2.1.3 The Resource Based Theory

This theory explains how entrepreneurs themselves build businesses from the resources they currently posses or can realistically acquire in order to gain a sustained competitive advantage (Dollinger, 1999).

The resource based theory argues that the choice of which industry to enter and what business to be in is not enough to ensure success. The theory says that the nature and the quality of the resources the entrepreneur posses and can acquire can lead to long run success. The theory treats entrepreneurs-the individual–as important unique resources to the firm, resources that money cannot buy. The resource based theory contests the assumptions of the purely economic theories of industrial organization and strategy by assuming that resources distributed among firms are heterogeneous and immobile (Ntere,2006).

The resource based theory holds that sustainable competitive advantage (SCA) is created when firms possess and employ resources that are: Valuable because they exploit some environment opportunity; Rare in the sense that there are not enough for all competitors; imperfectly imitable so that competitors cannot merely copy them; Non-substitutable with other resources.

When a firm possesses and controls resources with these four characteristics, it can withstand competitive and imitative pressures. If the new enterprise can protect these resources and maintain these four qualities, it will have competitive advantage over the long term. The resource based theory recognizes six types of resources: financial; physical; human; technological; reputational and organizational. These six types are broadly drawn and include all assets, capabilities, organizational processes, firm attributes, information and knowledge.

### 2.2 Empirical Review

Namusonga (1998) viewed entrepreneurial development to entail changing of attitudes in a way that inculcate in potential entrepreneurs the “philosophy of winners” that gives them a visionary focus. He further adds that strategic entrepreneurship development and promotion of an enterprise culture can produce a mass of creative and innovative Kenyan capable of developing into high - profile entrepreneurs and industrialists, especially among women and youth. Namusonga (1998) further emphasized the crucial part that literacy plays in the success of entrepreneurs. He noted that the level of knowledge, skills and attitude required by entrepreneurs is highly influenced by the sophistication and basic education. The Kenya government has, also recognized the importance of literacy in entrepreneurship.

Berheim, Garret and Maki (2001) observed that financial education for youths increases savings rate in adulthood. They say that “at each stage of life one needs to learn some financial tips and tools geared towards saving and stretching earnings. Morris and Somerset (1971) and Marharia (1989) suggested that a large number of small business enterprises have not expanded partly due to lack of relevant information.

Githae (2004) observed that there is existence of disparities between training of the small enterprises sector and the supply of trainers, lack of closer collaboration between training institutions and employers and presence of poor and inadequate training. Hence the above literature review indicates that literacy level is a vital /critical success factor in entrepreneurship.
Bennet & Canvas (1995) details that developed countries save a large portion of incomes and accumulate greater wealth than developing countries. In fact developing countries have very low or negative savings or investments rates or even they survive by borrowing. Recent evidence indicated that most developing countries are still pleading with International monetary Fund and World Bank, in order to write off their debts. This is an indication that there is still a lot to be done in order for the developing countries to cross the poverty line. The effect of the continental poverty thus goes down to the household level.

Wolff (2001) observed that “the board pattern is that accumulation of assets in the typical US household largely occurs via home ownership and retirement pension accounts.” This evidence is typically of developed countries. For developing countries like Kenya this may not be very practical in that most of the pension-able lot have no assets due to persistent and carried forward poverty over years. This hinders savings and investment opportunities throughout their lives.

Education however, through training, increases savings of all types as shown in recent studies. In another study, Bernheim, Garret and Maki (2001) observed that financial education for the youth increases savings rate in adulthood. Colleges teach the value of savings. Clarke, Cull and Pería (2001), for example, investigate the impact of foreign bank penetration on lending to SMEs. They found that foreign bank penetration increases the share of financing from banks and lowers financing obstacles as perceived by firms, particularly in the case of large firms.

Love and Mylenko (2003) explore how credit-reporting institutions affect financing constraints. The authors found that private credit registries relax financing constraints and increase bank financing, particularly for SMEs. By contrast, public registries do not have a significant effect. Beck et al. (2003) studied the impact of bank concentration on firms’ financing obstacles and access to credit. They found that in countries with low levels of institutional development, bank concentration leads to higher obstacles and a lower share of bank financing, particularly in the case of SMEs.

Finally, Galindo and Micco (2004) explored on the impact of several measures of creditor rights protection on the share of financing from banks. They found that creditor rights increase access to financing by SMEs relative to the effects on large firms. The training needs of growing businesses vary substantially and relate primarily to the development of broader aspects of management of the business, such as market diversification, product design, marketing, and access to finance, technology and networks.

Oketch (1995) indicated that apart from lack of credit, education level is another factor which poses a challenge to small scale enterprise; he noted that almost 40% of the entrepreneurs with high school or university education have accessed credit in the past compared with 24 %of their counterparts with up to four years of education. In the economic managerial for renewed growth policy (GoK, 1992) the government appreciates the acquisition of relevant vocational, technical and business skills as one of the critical factors necessary for growth and development of micro and small enterprises. The policy provide for technical and vocational training at the primary and secondary levels.

Okoth (1995) observed that education level is a factor that influences entrepreneurship. According to his survey almost 40% of the entrepreneurs with high school or university education have accessed credit in the past, compared with 24 % of their counterparts with up to four years of education.

2.3 Critique of Existing Literature and Research Gaps
The study by Helmsing and Thikolstee (1993) does not conform to the recent situation where we still find that the SMEs still face limited access to market, high transaction cost, poor infrastructure, lack of marketing knowledge, low investment, and limited skill and management know-how. Until recently, lack of comparable data hampered attempts to study the determinants of financing constraints for small enterprises in a cross-country context.

For the most part, these studies look at the impact on credit constraints of a single explanatory variable (such as foreign bank penetration, bank competition, availability of credit registries, or creditor rights) and do not attempt to bring all the potential determinants together into the analysis.

A report by the Ministry of Youth indicated that the youth enterprise fund is benefiting high number of youths in the country due to employment opportunities created through the enterprises (GoK, 2007). These findings however are not a true reflection of what is now happening in the country. The Uwezo fund has age restrictions which now bars the able youth from accessing the funds. The age limit of 35 years is rather on the lower side considering that most people who want to engage in horticulture are in the age of 40 years.

The regulation also requires the youth to form groups. People have different interests and want to pursue their dreams differently. This makes it difficult for the youth to form legible groups and for those groups that are formed, managing them becomes a big problem, (World Bank Report, 2010).
In Kirinyaga county according to the First Kirinyaga County Integrated Development plan (KCIDP, 2013) small enterprise sector will be provided with cheap but appropriate agricultural equipment as well as providing the necessary infrastructure. Among key priorities in the Kirinyaga County Development plan for the period (2013-2017) is enhancement of entrepreneurship through sensitization of indigenous entrepreneurs in processing, management and marketing. There is high concentration of stakeholders in Kirinyaga production area, which is equally very active in export horticulture business. It is only in Kirinyaga where GTZ/PSDA supported Global GAP activities—supported MoA’s national wide sensitization campaigns and farmer trainings, gave grants for establishing common infrastructure as part of Global GAP compliance and also gave small loans to farmer groups to facilitate initial compliance at farm level. Donors and HCDA used collective action as their entry point in the community (KCIDP, 2013).

However, although Global GAP is a private standard, it is a mandatory condition for entry in EU markets, which is the main destination for Kenya’s export horticulture (Graffham, 2006). Enforcement of Global GAP has been feared to exclude smallholder farmers from the lucrative export market because many lack sufficient resources and necessary skills to acquire and maintain compliance (Muriithi et al., 2010). The government of Kenya and in particular the Kirinyaga County should come up with a way of establishing regulations that will ensure that the exporters fully support the small farmers in conforming to the Global GAP standards.

Until recently, lack of comparable data hampered attempts to study the determinants of constraints for youth enterprises in a cross-country context. The available data from the World Business Environment survey has led to a number of studies on the determinants of the constraints (World Bank Report, 2000). For the most part, these studies look at the impact on startup capital constraints which is a single explanatory variable excluding the market accessibility, literacy levels and leadership and do not attempt to bring all the potential determinants together into the analysis. Secondly, the horticulture market is increasing being affected by tougher rules and standards which affect the performance of horticulture exports. Further studies need to be done on how to counter these new regulations.

3. METHODOLOGY

The study applied descriptive design because the study seeks to answer the why, how and when of the problem under study. The research design was a survey conducted on a sample of Horticulture exporting youth groups Kirinyaga County. According to Owens (2002), survey research designs has the advantage of uniqueness since information gathered is not available from other sources, having unbiased representation of population of interest and standardization of measurement as same information is collected from every respondent.

The target population consisted of all the horticulture exporting youth groups within Kirinyaga County. From the records of Kirinyaga County, there are 440 horticultural export groups within the county. The businesses in operation are mainly in tomatoes, passion fruits, French beans, soya beans and sweet melons as shown in table 3.1:

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>80</td>
</tr>
<tr>
<td>Passion fruits</td>
<td>90</td>
</tr>
<tr>
<td>French beans</td>
<td>200</td>
</tr>
<tr>
<td>Soya beans</td>
<td>30</td>
</tr>
<tr>
<td>Sweet melons</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>440</strong></td>
</tr>
</tbody>
</table>

The following sampling formula by Mugenda and Mugenda (2003) for calculating sample size of a population that is less than 10,000 was applied to pick the sample size:

\[
\frac{n}{n_f} = \frac{1}{n/N + 1}
\]

Where:  
\( n_f = \) the desired sample size (when the population is less than 10,000)  
\( n = \) the desired sample (when the population is more than 10,000)  
\( N = \) the estimate of the population size

\[
\frac{384}{1 + 384/440} = 205
\]

This gives a sample size of 205 respondents as indicated in the table 3.2 below. The sampling frame included: tomatoes, passion fruits, French beans, soya beans and sweet melons.

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Sample proportion</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passion fruits</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>French beans</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soya beans</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet melons</td>
<td>40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The study applied stratified sampling technique where 46% of the population in each sampling frame was selected to participate in the study. For the exact individuals to participate in the study, the researcher used simple random sampling technique as it offers every member of the population an equal chance of being included in the sample. The study employed the use of semi-structured questionnaires to collect primary data. The questionnaire was administered through drop and pick-later method to the sampled population.

To increase validity of the study, data was collected from reliable sources. The researcher also obtained authority from relevant authorities to administer the questionnaires. A pre-test of 5% of the population size was conducted to give a representation of the selected population thus the designed questionnaire was tested on 22 potential respondents. Piloting of the research instrument was necessary for various reasons: It helped to clarify the wording and grammar of the instrument so as to avoid misinterpretations; to avoid research bias; detect ambiguous questions; and to pick out in advance any problems in the methods of research. This helped to make the data used in the analysis valid.

To test the reliability of the Likert scale used in this study, reliability analysis was done using Cronbach’s Alpha as the measure. A reliability co-efficient of $\alpha \geq 0.7$ was considered adequate in indicating a high level of internal consistency for the Likert scale used. This process assisted in addressing any weaknesses with the questionnaire and the general survey technique of the research. Improvements and editing was then made on both the structure and content of the research tool to reduce the errors.

The researcher administered the questionnaires to the relevant respondents in an effort to achieve the necessary information. Research assistants were used to assist the researcher in gathering the information. The assistants were trained so that they understand the research study and what was expected of them. The research assistants were trained on the aspects of the questionnaire and how to handle the respondents to ensure that they observed ethical considerations. Self-administered questionnaires allowed the participants to respond to the questions by themselves and at their own pace.

The questionnaire was checked for completion. Qualitative analysis consisted of examining, categorizing, tabulating and recombining evidences to address the research questions. Qualitative data was grouped into meaningful patterns and themes that are observed to help in the summarizing and organization of the data. Quantitative data was analyzed through the use of statistical techniques such as frequency counts, percentages, arithmetic means, modes, pie charts and tabulation to show differences in frequencies.

Qualitative data was analyzed descriptively through the use of questionnaires. Bar charts were used to display nominal or ordinal data. Statistical Package for Social Sciences (SPSS) was used to aid in coding, entry and analysis of quantitative data obtained from the closed ended questions. Quantitative data was presented through the use of statistical techniques such as bar charts, pie charts, percentages and frequency counts. Qualitative data was presented descriptively.

4. FINDINGS AND DISCUSSION

4.1 Response Rate
During the research study the researchers distributed 205 which reflected 100% questionnaires. This was equivalent to the sample size that was adopted for the study. The response rate is illustrated in table 4.1:

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaires Distributed</td>
<td>205</td>
<td>100</td>
</tr>
<tr>
<td>Questionnaires Returned</td>
<td>180</td>
<td>87.8</td>
</tr>
</tbody>
</table>

The above table shows that from the 205 questionnaires that were distributed 180 questionnaires were fully filed and returned. This constitutes a 87.8% response rate. According to Kothari (2009), a 50% response rate is considered adequate hence the response rate in this study was considered a good for the purpose of analysis and interpretation.
4.2 Demographic Information
The items on the first section of the respondent’s questionnaire was on gender, age, kind of business, years of experience academic level. This served as an unprejudiced way of carrying out an in-depth analysis with regard to factors influencing entrepreneurship. The information obtained is contained in the tables below.

4.2.1 Gender of Respondents
According to the sample taken, out of 180 respondents involved in the study, 36 (72%) were males and 14 (28%) more females. The low participation of female respondents is accounted for by the fact that the nature of producing the product is a bit technical and muscular hence attract male more than females. This is shown in the table 4.2:

Table 4.2: Gender of Respondents

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>120</td>
<td>67%</td>
</tr>
<tr>
<td>Female</td>
<td>60</td>
<td>33%</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.2.2 Age of Respondents
On the age of the respondents, the findings were that 132(73%) were in the 20 to 35 years age bracket, while 38(21%) were in the 36-50 years age bracket. This shows that majority (73%) were with the age bracket selected by the researcher as composing of youth that is 0-35 years of age. This is shown in the table 4.3:

Table 4.3: Age in years

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35 YEARS</td>
<td>132</td>
<td>73%</td>
</tr>
<tr>
<td>36- 50 YEARS</td>
<td>38</td>
<td>21%</td>
</tr>
<tr>
<td>Over 50 years</td>
<td>10</td>
<td>6%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.2.3 Type of Business Respondents Operate
This section aimed at establishing the type of horticulture crop produced by the youths. Most of the farmers 50% are producing French beans which are exported to the European countries. Tomato farmers 20% are next then followed by Passion Fruit farmers at 16%. The remaining farmers 14% comprise of sweet melon farmers, soya beans farmers, onion farmers, sweet corn farmers and pawpaw farmers.

Table 4.4: Type of Business Respondents Operate

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>36</td>
<td>20%</td>
</tr>
<tr>
<td>French beans</td>
<td>90</td>
<td>50%</td>
</tr>
<tr>
<td>Passion</td>
<td>28</td>
<td>16%</td>
</tr>
<tr>
<td>Others</td>
<td>26</td>
<td>14%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.2.4 Number of Years Respondents have been in Horticulture Farming
In regard to the year of horticulture farming, the findings were that 92(51%) had been operating for less than two years 60(33%) had been in operation for more than 5 years. Then 28(16%) has been operating for over six years. This shows that the group has a relative adequate experience to provide the information sought by this study as shown in table 4.5:

Table 4.5: Number of Years Respondents have been in Horticulture Farming

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- 2 years</td>
<td>92</td>
<td>51%</td>
</tr>
<tr>
<td>3-5 years</td>
<td>60</td>
<td>33%</td>
</tr>
<tr>
<td>Above 6 yrs</td>
<td>28</td>
<td>16%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100%</td>
</tr>
</tbody>
</table>
4.2.5 Highest Level of Respondents’ Education
On the highest level of education, the findings were that 47(26%) had only primary education, 98(54%) had secondary education, while 28(16%) were Diploma graduate and 7(4%) were university graduates. With reference to the study, the information on academic qualification shows that most of the youth had at least some education though not adequate for complex entrepreneurial functions. They were likely to be able to tackle some challenges in entrepreneurship as shown in table 4.6:

Table 4.6: Highest Level of Respondents’ Education

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>47</td>
<td>26%</td>
</tr>
<tr>
<td>Secondary</td>
<td>98</td>
<td>54%</td>
</tr>
<tr>
<td>Diploma</td>
<td>28</td>
<td>16%</td>
</tr>
<tr>
<td>Degree</td>
<td>7</td>
<td>4%</td>
</tr>
</tbody>
</table>

4.3 Business Skills Level of Respondents
On the skills possessed, (3%) had entrepreneurial skills, 7% had management skills,2% had management skills, 13% had some training on agriculture and 75% had no learned skills necessary for horticulture farming as shown in table 4.7:

Table 4.7 Business Skills Level of Respondents

<table>
<thead>
<tr>
<th>Skills</th>
<th>Entrepreneurship</th>
<th>management</th>
<th>marketing</th>
<th>Agriculture training</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>12</td>
<td>4</td>
<td>24</td>
<td>135</td>
</tr>
</tbody>
</table>

4.4 Learning more Skills and Performance
Farmers were asked to what extent do they think learning more skills would improve their performance in farming. 78% said that learning would greatly improve their performance, 3% said the change would be moderate while 34% said that there would be no improvement as shown in table 4.8:

Table 4.8: Learning more Skills and Performance

<table>
<thead>
<tr>
<th>Extent</th>
<th>Great extent</th>
<th>Moderate extent</th>
<th>Very little extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>140</td>
<td>6</td>
<td>34</td>
</tr>
</tbody>
</table>

4.5 Sources of Funds and Performance
This variable sought to identify the source of capital, availability of funds and the constraints. The findings were as follows.68% indicated relatives and friends as their source of capital, while 19% indicated it was from personal saving, 7% got loans from SACCOs and banks while 12% indicated other sources. This indicates that the majority are supported by their families and relatives.

Table 4.9: Sources of Funds and Performance

<table>
<thead>
<tr>
<th>Source</th>
<th>Frequency</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative and friends</td>
<td>122</td>
<td>68%</td>
</tr>
<tr>
<td>Personal Saving</td>
<td>34</td>
<td>19%</td>
</tr>
<tr>
<td>Loans</td>
<td>12</td>
<td>7%</td>
</tr>
<tr>
<td>Others</td>
<td>12</td>
<td>7%</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.6 Constrains Due to Lack of Funds and Performance
On availability of funds, the findings were that all respondents 100% said that money was not enough to run the activities in general. On constrains imposed by inadequacy of money 85% of respondents indicated it was very much, 21% indicated it was very much, 6% indicated was fairly much and only 3% indicated it was not much.

Table 4.10: Constrains Due to Lack of Funds and Performance
4.7 Middlemen or Intermediaries’ Effect on Entrepreneurship
The section was to investigate the impact of middlemen or intermediaries on entrepreneurship and how much it affects the operations of small entrepreneurs. Results from the findings indicate that individuals and groups (100%) do not sell their products directly to the exporter but to companies who buys from them and take to the exporting firms. On how much this affects their business, 68% reported that the effects are much, 12% indicated fairly much 16% indicated not much, while 4% said not at all.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very much</td>
<td>122</td>
<td>68%</td>
</tr>
<tr>
<td>Fairly much</td>
<td>23</td>
<td>12%</td>
</tr>
<tr>
<td>Not much</td>
<td>28</td>
<td>16%</td>
</tr>
<tr>
<td>Not all</td>
<td>7</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.8 Pricing of the produce Expectations
On the expectation of prices of their produce, the findings were that 16% said that the price was adequate, 72% low and 12% indicated it to be very low. The above findings reveals that the members were aware that they were not getting the full value for their produce and that the middlemen were actually exploiting them.

<table>
<thead>
<tr>
<th>Price expectation of the product</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate</td>
<td>29</td>
<td>16%</td>
</tr>
<tr>
<td>Low</td>
<td>130</td>
<td>72%</td>
</tr>
<tr>
<td>Very low</td>
<td>21</td>
<td>12%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.9 Effects of Technology Adoption on Performance
On the issue of effects of technology adoption, 80% said that they have a saving on the cost of production, 70% said they have increased product yields, 60% said that they have used technology in getting useful information that have helped in performance of their farm while 10% said their products have become less competitive.

<table>
<thead>
<tr>
<th>Effect of technology adoption</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low cost of production</td>
<td>60%</td>
</tr>
<tr>
<td>High yields</td>
<td>70%</td>
</tr>
<tr>
<td>Getting useful information</td>
<td>60%</td>
</tr>
<tr>
<td>Become less competitive</td>
<td>10%</td>
</tr>
</tbody>
</table>

4.10 Extent of Technology Adoption on Business Performance
This shows the extent to which technology adoption has affected the performance of horticulture farming. 60% said that technology has very greatly affected their business, 20% said it has great extent, 16% said there is little extent while 4% said the extent of effect is very little.
Table 4.14 Extent of Technology Adoption on Business Performance

<table>
<thead>
<tr>
<th>Impact</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very great extent</td>
<td>108</td>
<td>60%</td>
</tr>
<tr>
<td>Great extent</td>
<td>36</td>
<td>20%</td>
</tr>
<tr>
<td>little extent</td>
<td>29</td>
<td>16%</td>
</tr>
<tr>
<td>Very little extent</td>
<td>7</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100%</td>
</tr>
</tbody>
</table>

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Study Findings
The major purpose of this study was to look at the entrepreneurial factors influencing performance of horticultural exporting youth groups in Kirinyaga County. This was achieved through the use of research specific objectives and the research question out of which the study questionnaire was formulated to investigate how these challenges impacts on their performance. The major findings were that a range of challenges, which are both from within and entrepreneur’s confinement pose a lot of challenges on the running and performance of an enterprise. Among them being lack of finance, competition, market, technology and the regulating environment.

The first objective aimed at finding out how skills level among youths affects their entrepreneurships success. The findings from this study showed that lack of relevant training and knowledge is a factor that limits performance and success in enterprises amongst the youth. The youths said that they needed further specific training on business operations which includes general management, agriculture training, and entrepreneurship in general. This finding is in line with Namusonga (2000) finding on entrepreneurship development in which he found out that in spite of completing the formal education; the curricula school leavers had gone through does not equip them with required entrepreneurial skills. He went further to suggest that the reorientation of the curricula to introduce enterprise education in school a suggestion which this study highly support.

On the constraints imposed by lack of funds, which was the second objectives of this study, the findings was that most of the youth had a problem in getting the initial capital for their business start up. Further finding was that despite having managed to start, majority lack finances to sustain the venture. For example; they cited high cost of spraying chemicals for pests and diseases control on the crops, Vis a Vis the low prices their products fetch in the market. Expanding their business was also limited by lack of fund. Lack of funds also exposed them to hiring cheap inexperienced workforce. Many said that they were about to give up farming after crop failure and low prices which ate up their initial capital, raising more funds was proving difficult and risky and were therefore opting to quit.

On the challenges posed by the market availability and accessibility, the study established that access to the market is a major problem and middlemen have maximized on taking advantage of this to exploit entrepreneurs. Ignorance and lack of funds were attributed to be the reason for this. For example the study established that the various groups cannot afford to take their produce to Nairobi where they can sell direct to the exporting firms. Middlemen buy the produce direct from the farms and block any new buyer by forming cartels. Further, the study found out that the middlemen take advantage of the buyers ignorance where they arbitrarily violate their agreement between them especially when the produce floods the market by sometime failing to collect the goods on agreed days, hence going into waste.

Lastly, the study looked at the impact of technology adoption, and what contribution it has made on their business performance. The study established most of the youths are not able to adopt technology due to lack of knowledge and funds. They argued that technology was expensive and complicated and thus was difficult to adopt. However, they said that the little technology they have adopted, it has a great impact on their business. They said that their businesses would perform much better if they were able to adopt the technology.

5.2 Study Conclusions
Based on the findings of this study the researcher concluded that small scale enterprises play a vital role in keeping the youths in productive ventures and also in making them self reliant through provisions of self employment. The study concluded that lack of relevant training and knowledge, getting the initial capital for business start up, access to the market and technology adoption remained the limiting factors to the performance and success of horticulture farmers in Kirinyaga County. A combined effort by
relevant authorities like the government, training institution and credit lending institution should be encouraged to ensure a conducive 
operating and regulatory environment for small scale enterprises.

5.3 Policy Recommendations of the Study
On the bases of the finding and conclusion of this study the following recommendations were proposed: the government to come up 
with appropriate measures which will empower youths to take advantage of the opportunities provided by the small scale enterprises 
sector, training institutions offering entrepreneurial and marketing skills especially in rural areas should be strengthened to serve 
micro-enterprises. Vocational centre to include business studies. Further special training program should be organized to training 
youths already in business ventures.

The government to facilitate the success of small enterprises owned by youths through ensuring fund kits like youth development fund 
which benefit the youths and are not misappropriated. Youth development fund is already working well in Embu County where 
youths are funded by the county government. The government should encourage the youths to form stronger groups then source 
for market for their products. The government should facilitate acquiring of cheaper agriculture tools and chemical and easy access to 
cheaper internet, embrace new farming technology in counties that will help the farmers

5.4 Recommendations for Further Studies
Further studies should also be conducted on the following areas: Government funded SMEs and their success, the role of the 
government in success of small scale business and entrepreneurial training and the success of small scale enterprises.

REFERENCES
Anita Du Rietz1 & Magnus Henrekson (2000) Testing the Female Underperformance Hypothesis, small business economics vol 
14, Stockholm School of Economics & Research Institute of Industrial Economics


A Barno, B Ondanje, J Ngwiri (2009), dynamics of Horticultural Exports to and Opportunities in Sub-Saharan Africa. All Africa Horticultural Congress.

F. Bruinsma (2008), Managing The transition to renewable Energy. Theory and practice from local, Regional and Macro perspective.


Kenya Development Learning Centre (KDLC), (2010) Smallholder farmers’ involvement in perspective. Video conference on high value horticulture for Eastern & Southern Africa

Kenya Management Assistance Programmed (1996), survey on legal impediments to small business development in Kenya Nairobi, Kenya


United Nations Industrial Development Organization (UNIDO), Effective policies for small business – a guide for the policy review process and strategic plans for SME development.

Yasemin Kor (2001), Why do Managerial Resources and Management Teams Matter? Darla Moore School of Business University of South Carolina