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# Family life education in Schools: An investigation on Parents' attitude in Tamil Nadu

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**Abstract-** In this paper an attempt is made to assess parents' attitude towards offering of sexuality education at schools. The study was conducted during 2016 in five districts of Tamil Nadu. Totally 529 respondents were interviewed. A multistage sampling method was adopted to select the target population - ever married couples living with at least one child in the age group of 13-19 years. In the study area majority of the study population had the opinion to introduce the family life education to the students however the female respondents little more favour to introduce the sexuality education for students than the male respondents. It also noticed that among the religious groups, Muslims less favoured to teach sexuality education for students. Irrespective of the respondents' background condition majority of them were favoured to introduce family life education. Hence it is recommended that the teaching of sexuality education in schools should be made compulsory at national level. However it should be age appropriate and culturally sensitive keeping with the current SRHR needs of young people in India.

## I. INTRODUCTION

Adolescents are growing up in the world in which they experiment more, make choices and take risks and learn by their own experiences than by those of others. Many research studies have documented that generally adolescents lack of adequate knowledge on sexuality matters which results in early pregnancy, increased pre-marital sexual activity, increased risk of RTI/STIs including HIV/AIDS, maternal morbidity and mortality and unsafe abortions (Mahajan and Sharma, 2005). Many times, the adolescent receives incorrect information about sexuality and these myths and misconceptions are carried throughout their lifetime. Therefore, there is a need to provide Sexuality education which provides young people with the knowledge, skills and efficiency to make informed decisions about their sexuality and lifestyle (UNSEC, 2009) to adolescents so as to enable them to cope better with these changes. Under this backdrop this paper made an attempt to examine the parents' attitude towards offering of sexuality education at schools.

## II. METHODOLOGY

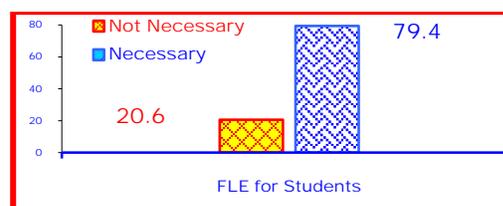
This study was conducted at Trichy, Kancheepuram, Thirunelveli, Cuddalore and Dharmapuri districts in Tamil Nadu during 2016 among 529 parents. The multi stage sampling technique was applied to select the sample districts, taluks, villages and the target population. As a first step in the selection of study population, house listing was conducted to identify the

ever married couples living with at least one child in the age group of 13-19 years. Totally 1960 households were indentified in 11 urban locations and it was decided to select one-fifth of the respondents from each of the urban locations. Total number of respondents who cooperate and completed the entire interview episode was 303 at the urban area. A similar method was applied to select the rural households. Totally 226 households' respondents were cooperate and completed the entire interview episode. Therefore the total sample size is 529.

## III. RESULTS

During the survey, the respondents were asked to state their opinion on 'Is it necessary to have sexuality education for students'. In the study locations, little less than eighty percent of the respondents had the opinion that the family life education or sexuality education is necessary to teach for the students. It is believed, generally, that people are not in-favour of sexuality education however in the study area majority of the study population had the opinion to introduce the family life education to the students. It indicates the hesitation against the sexuality education is decline in the society it may be due to the wake of new socio-economic progress.

**Association between background characteristics and the Respondents' Opinion on providing of Family Life Education for students:** An attempt is made to study the effect of background characteristics of the respondents on their opinion to launch family life education for students which may help to identify the differentials in their acceptance caused by socio-economic differentials.



**Percentage distribution of Respondents by their Opinion to introduce FLE**

**Table No. 1 Percentage distribution of Respondents by Opinion to introduce FLE for students with their Age and Sex**

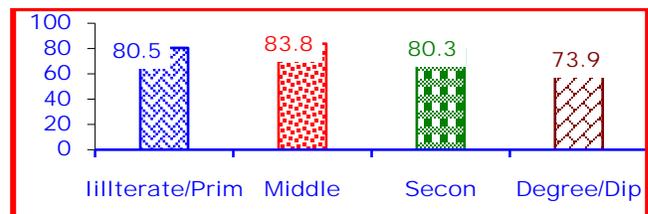
Respondents' Characteristics	Socio-Demographic	Opinion to offer FLE to students	Total
<b>Age<sup>NS</sup></b>			
Less than 35 years		77.7	121
36 – 40 Years		82.7	197
41– 447years		77.3	211
<b>Sex<sup>NS</sup></b>			
Male		78.3	212
Female		80.1	317
<b>Place of Residence<sup>NS</sup></b>			
Rural		82.7	226
Urban		76.9	303
<b>Family Type*3.450</b>			
Nuclear system		81.3	400
Joint system		73.6	129
<b>Religion * 7.019</b>			
Hindu		82.8	297
Muslim		70.9	110
Christian		78.7	122
<b>Caste* 9.832</b>			
SC		83.7	123
MBC		82.8	128
BC		72.9	218
FC		86.7	60

Chi-Square results: \* Sig. at 10% level; NS Not significant

Data shows that irrespective of age groups, a major proportion of respondents had the opinion that it is necessary to have sexuality education for students. However the proportion of persons who had accepted to launch the sexuality education for students was comparatively high in the 36-40 years age groups (82.7 percent) than the counterparts. It is quite contradictory to note that more or less equal proportion of the old age respondents (41-47 yrs) and young age respondents (> 35 yrs) in-favour of induction of family life education to the students which was less than the middle age population (36-40 yrs) in the study area.

An interesting observation is made with regard to the opinion to provide sexuality education in schools by sex of the respondents. In the study locations, female respondents little more favour to introduce the sexuality education for students (80.1 percent) than the male respondents (78.3 percent). As expected the respondents who live in the joint family system not much support to introduce the sexuality education for students. Data discloses that around 74 percent of the respondents who live in joint system had the opinion to launch the sexuality education and this proportion was further increased to 81.3 percent for the respondents living in nuclear family system. Data on religious analysis reveals that a considerable proportion of respondents in each of religious categories had favour opinion on introduction of family life education for students (Hindu 82.8 percent; Muslim 70.9 percent; and Christian 78.7 percent). Similarly majority of the respondents in each of the caste categories were favour of family life education at schools except BC category. The percentage of persons who had the favour opinion to offer the family life

education was comparatively high among FC (86.7 percent) and SC category (83.7 percent) than the counterparts.



**Percentage distribution of Respondents by their Opinion to introduce FLE by Educational Status**

The diagram did not show any major differences among the educational categories with respect to their opinion to offer FLE for students. It means, irrespective of their educational attainment, majority of them had the opinion that the students should receive the sexuality education. However, a quite contradictory observation also made that among the educational attainment categories, the degree/diploma holders reported lowest proportion (73.8 percent).

Data evident that majority of the respondents in each of the occupational categories reported that it necessary to have family life education for students. However, the proportion was ranged from 77.4 percent for 'not working' category to 84.8 percent for the 'wage laborer/former' category respondents.

**Table No. 2 Percentage distribution of Respondents by Opinion to offer FLE for students with their Occupation and Monthly Income**

Economic Status of Respondents	Opinion to introduce FLE	Total
<b>Occupation<sup>NS</sup></b>		
Not Working	77.4	199
Govt./ Private sector	78.1	178
Self employed	82.2	73
Wage labour / Former	84.8	79
<b>Monthly Income<sup>NS</sup></b>		
Up to 5000	81.1	111
5001 - 10000	78.2	156
10001 -20000	84.5	148
Above 20000	72.8	114

Table 2 shows the linkage between respondents' income level and their opinion to provide of sexuality education for students. Again it is proved that irrespective of their monthly income categories, most of the respondents had the positive attitude to provide sexuality education for the students. Generally mass media exposure will have an optimistic influence on the respondents' opinion. However, data on opinion towards launch of sexuality education for students shows pessimistic results - while the respondents' exposure on mass media increases their opinion towards introduce the sexuality education for student was decline. Out of 190 respondents who had less exposure to mass media, 83 percent of them favour to offer the sexuality education for the students whereas this proportion for the highly media exposed population was around 76 percent. Chi-square results clearly shows that the socio-economic demographic characteristics of the respondents not shown any strong influence on their opinion towards providing of family life education for students.

In this study an attempt also made to assess the effect of respondents' degree of religiosity on respondents' opinion towards to offer of family life education for students. The respondents' level of religious involvement increases their opinion to introduce family life education for the student was decreases. In the study area, more than eighty percent of the respondents who fall in the less religious involvement index had

the positive attitude towards to launch of sexuality education for the students (86.5 percent). This proportion was decline to 72 percent for the persons who had high level of religious involvement. It can be stated that the respondent's degree of religiosity have a negative impact on the respondent's attitude towards launch of sexuality education for students. More and more religious affinity or involvement may lead to have negative view of sexuality education. It is evident from the Chi-square analysis that a significant association is noticed between degree of religiosity and opinion to sexuality education for students ( $\chi^2=8.906$ , at 10%level). Similarly, majority of the respondents were in-favour of sexuality education for students, irrespective of their level of religious commitment. However while the respondents' level of religious commitment increases their opinion towards to offer sexuality education for the students was decline. This decline was from 85.7 percent to 73.0 percent to the respective index categories. It can be again proved that the respondent's degree of religiosity have an optimistic influence on opinion to offer sexuality education for students. It is evident from the Chi-square analysis that a significant association is noticed between the level of religious commitment and their opinion on sexuality education for students ( $\chi^2=12.171$ ,  $p=.000$ ).

**Table No.3 Percentage distribution of Respondents by Opinion to offer FLE for students with their Sexuality perception index**

Perception index on Sexuality	Opinion to introduce FLE	Total
<b>Sexuality Understanding<sup>NS</sup></b>		
Less understanding	75.3	97
Moderate	79.3	319
High	83.2	113
<b>Perception on Sexual relationship*** 11.631</b>		
Low perception	67.3	104
Moderate perception	81.9	287
High perception	83.3	138

Chi-Square results: \*\*\*Sig. at 1% level, NS Not significant

This table explains the influence of understanding of sexuality of the respondents on their opinion to offer sexuality education for the students. While the respondents' understanding on sexuality increases, their acceptance towards sexuality education for the students was increases. Data shows that about three-fourth of the respondents who fall in the less sexuality understanding index had the opinion to introduce sexuality education for the students. This proportion was increased to 79.3 percent among the moderate level and further increased to 83 percent for the persons who fall in the high level of understanding on sexuality. Similarly while the respondents' perception on sexuality relationship increases their approval of sexuality education for the students was also increases. About 67 percent of the respondents who fall in the low perception on

sexual relationship category agreed to launch the sexuality education for the students. This proportion was increased along with their level of perception on sexual relationship increases – 83.3 percent for the high level of perception category. Bivariate analysis shows a significant association between understanding of sexual relationship and their opinion on sexuality education for the students ( $\chi^2=11.631, p=.000$ ).

Table 4 presents the results of the logistic regression analysis which provide the independent effects of different background variables on the respondents' opinion on sexuality education for the students in the study area.

**Table No. 4 Results of logistic regression for determinants of acceptance of sexuality education among the study population**

SED Characteristics	B	S.E.	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
					Lower	Upper
<b>Age<sup>NS</sup></b>						
> 35 years (R)			.245	1.000		
36 – 40 Years	.382	.317	.227	1.466	.788	2.727
41– 447years	-.047	.321	.882	0.954	.509	1.788
<b>Sex<sup>NS</sup></b>						
Male (R)				1.000		
Female	.194	.372	.601	1.215	.586	2.517
<b>Religion<sup>NS</sup></b>						
Hindu (R)			.755	1.000		
Muslim	-.246	.350	.482	0.782	.394	1.553
Christian	-.009	.310	.977	0.991	.540	1.819
<b>Caste*</b>						
SC (R)			.068	1.000		
MBC	-.030	.355	.932	0.970	.484	1.946
BC	-.335	.335	.318	0.715	.371	1.380
FC	.876	.497	.078	2.401	.907	6.360
<b>Place of residence<sup>NS</sup></b>						
Rural				1.000		
Urban	-.112	.259	.666	0.894	.538	1.485
<b>Family Type<sup>NS</sup></b>						
Nuclear (R)				1.000		
Joint	-.387	.259	.135	0.679	.409	1.128
<b>Educational<sup>NS</sup></b>						
Illiterates/Primary (R)			.315	1.000		
Middle	.332	.392	.397	1.394	.646	3.009
Secondary	.147	.414	.723	1.158	.515	2.605
Degree/Diploma	-.277	.441	.530	0.758	.320	1.798
<b>Occupation<sup>NS</sup></b>						
Not working (R)			.625	1.000		

Private/Public sector	.471	.409	.250	1.601	.718	3.568
Self employed	.500	.431	.246	1.649	.708	3.842
Wage/Formers	.166	.417	.690	1.181	.522	2.675
<b>Mass Media</b> <sup>NS</sup>						
Less exposure			.505	1.000		
Moderate	-.077	.317	.808	0.926	.498	1.722
High	-.367	.339	.279	0.693	.356	1.346
<b>Degree of religiosity**</b>						
Low degree			.013	1.000		
Moderate	-.369	.384	.336	0.691	.325	1.467
High	-1.002	.408	.014	0.367	.165	.816
<b>Sexuality Understanding</b> <sup>NS</sup>						
Less understanding			.341	1.000		
Moderate	.321	.301	.286	1.379	.764	2.487
High	.541	.373	.147	1.717	.826	3.568
Constant	1.551	.722	.032	4.716		
-2 Log likelihood 499.236						

\*\*\*Sig. at 1% level, \*\*Sig. at 5% level, \* Sig. at 10% level; NS Not significant; (R) Reference category

The results indicated that the odds ratio of opinion of respondents towards to offer sexuality education for the students compared to the reference category during the reference period, when the effects of other variables were controlled. The dependent variables were dichotomous in nature taking the value of one if it was reported that a person had optimistic view on sexuality education for students (yes=1; no=0). The explanatory variables included in this model were: age, sex, place of residence, religion, caste, education, occupation, monthly income, family types, media exposure, degree of religiosity and understanding of sexuality. The odds ratio shows 36-40 years age population were about 1.4 times more likely to have the optimistic view on sexuality education for the students than less than 35 years age population. The analysis confirmed the sex differences observed in the bivariate analysis with the lowest acceptance of sexuality education for students among male respondents and highest acceptance of sexuality education for students among female students. It is noticed from the odds ratio that Christians (OR= 0.991) and Muslims (OR=0.782) were less likely to favour of introducing sexuality education for students than the Hindus. Data shows that FC category persons were about 2.4 times more likely to accept the sexuality education for the students than the SC category population. And at the same time the odd ratio of BC (OR= 0.715) and MBC (OR=0.970) respondents were less likely to favour of introducing sexuality education for students than the SC population. As compared with nuclear family system, respondents living in the joint family system were about 67 percent less likely to favour of introducing sexuality education for students. Degree of religiosity had significant negative effect on acceptance of sexuality education for the students. The respondents who had high level of degree of religiosity were less likely to favour of introducing sexuality education for students (OR=0.367) than the reference category. It is inferred that the sexuality understanding index found to be an

important indicator and confirm positive association with acceptance of sexuality education for the students. The respondents who had high level of understanding on sexuality were about 1.7 times more likely to favour of introducing sexuality education for students than the reference category. Overall, Caste and Degree of religiosity of the respondents alone have shown any kind of statistical association with the dependent variable with the respective reference categories.

#### IV. CONCLUSION

Over all, the research provides evidence that parents are having favorable attitude towards young people sexuality and sexuality education. The support of females towards offering of sexuality education at schools is higher than the males. It also noticed that among the religious groups, Muslims less favoured to teach sexuality education for students. The people those who had already better understanding about sexuality are more in-favour to introduce the sexuality education than those who had less understanding about sexuality. Hence it can be concluded that there is a strong unmet need for sexuality education and majority of the parents who participated in the research irrespective of their religious background and religiosity have favoured to introduce CSE. It is recommended that the teaching of sexuality education in schools should be made compulsory at national level. The curriculum should be with basic principles of equity, and sex positive and a gender sensitive approach. It should also be age appropriate and culturally sensitive keeping with the current SRHR e needs of young people in India.

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# THE INFLUENCE OF CORPORATE GOVERNANCE AND OWNERSHIP STRUCTURE ON PROFITABILITY

Herawanto, ErnieTisnawatiSule, Maman Kusman,Nury Effendi

**Abstract:** This study aims to examine the influence of Corporate Governance and Ownership Structure on the profitability of Indonesian Banking. The method used is explanatory. The population of this research is banking companies listed on the Indonesian Stock Exchange in 2008-2015. The purposive sampling method is used in the selection of samples to obtain a sample of 28 banking companies with total observations of 224 observational data for 4 years. Based on the hypothesis testing, the result shows that simultaneously Independent Audit Committee, Independent Commissioner and Foreign Ownership affect on profitability (ROA) of the banking industry with the influence 30.25% while the rest of 69.75% influenced by other variable not included in this model. Based on partial hypothesis testing show that partially Independent Audit Committee does not affect on Profitability (ROA) while Independent Commissioner and Foreign Ownership have partial influence to Profitability (ROA) of banking industry.

Keywords: *Corporate Governance, Ownership Structure, Profitability*

## Introduction

To invest in industries in Indonesia, the financial performance of a company is generally viewed in terms of profitability. Investors basically seek profit from the increase in investment (capital gains) and from the profit gained from the business, so that the level of profitability makes an industry has a strong appeal to investors.

Profitability of a company is reflected in its return on assets (ROA) ratio. The ROA achieved by the national banking industry has been down to 4.2% (2014) from 4.9% (2013) as reported in LPI 2014 as it is overshadowed by the dynamics of the global economy and slowing domestic economic growth before it becomes 5.3 % (2015) as reported in LKOJK 2015. Although this figure remains relatively high, especially when compared to similar industries in ASEAN and other countries.

Corporate governance explains the relationship between the various participants in the company that determine the direction of the company's performance. According to Nasution and Setiawan (2007), corporate governance is a framework in improving corporate performance through supervision or monitoring of management performance and ensuring accountability of management to stakeholders by basing on the regulatory framework. Corporate governance is realized in order to achieve a more transparent corporate management for all users of financial statements.

Company performance, in this case is profitability, would be good if the company is able to control the behavior of top executives to protect the interests of the company owner (shareholder), one of them through the existence of audit committee. The audit committee is expected to be able to oversee the financial statements, external audits and the internal control system in accordance with the Decree of the Minister of State-Owned Enterprises No. 117 / MMBU / 2002. To meet the Good Corporate Governance guidelines to maintain the independence and effective, appropriate as well as fast decision making, the company must have an independent commissioner at least 30% (thirty percent) of the total members of the board of commissioners (Pratiwi, 2010). As a result, the role of independent board of commissioners can improve the quality of earnings by limiting the level of earnings management through the monitoring function of financial reporting.

According to Wahyudi and Pawesti (2006), ownership structure is able to influence the course of the company which ultimately affects the company's performance in achieving the company's goal that is to maximize the enterprise value. Ownership structure in Indonesia has different characteristics with

companies in other countries. Most companies in Indonesia have a concentrated proprietary tendency so that the founders can also sit as boards of directors or commissioners. In addition, agency conflicts can occur between managers and owners and also between majority and minority shareholders. Cibberber & Majumdar (1999), Patibandla (2002), and Douma et al. (2003) examine the effect of foreign ownership on firm performance and found that foreign ownership positively affects the firm's performance, which is reflected in its profitability.

## **Corporate Governance**

The theory of corporate governance comes from the principal-agent problem in the agency theory that generates agency costs. The agency theory is then further developed into stewardship theory and stakeholder theory as well as evolving to resource dependency theory, political theory, legitimacy theory and social contract theory (Yusoff and Alhaji, 2012). Corporate governance is a way to monitor the relationship between the management of the company (agent) with its principals and wider with its stakeholders. The implementation of corporate governance is not standard (not "one-size-fits-all"), but varies widely across countries and companies (OECD, 2000).

The guideline of Indonesian Banking Good Corporate Governance (GCG) according to National Committee of Corporate Governance Policy states that GCG contains 5 (five) main principles: transparency, accountability, responsibility, independency and fairness. Corporate governance is a guideline for managers to manage companies with best practice. Managers will make financial decisions that can benefit all stakeholders. Managers work effectively and efficiently so as to lower capital costs and to be able to minimize risks. The effort is expected to generate high profitability.

According to Neeshu (2014), there are 3 (three) types of corporate governance mechanisms and controls known in the world. First, the internal mechanisms that comes from internal mechanisms and with function to monitor organizational progress and activities and take corrective action if the organization deviates from the set objectives. These types of mechanisms include internal control by management, independent internal audit, and structure of the Board of Directors. Second, external mechanisms that comes from outside the company with the function, among others, for compliance with regulations. This type of mechanism is in the form of authority / regulator and government. Third, independent audit, which serves to audit financial statements for internal and external stakeholders of the company.

This study uses a measure of corporate governance through the proportion of independent audit committees and the proportion of independent commissioners. In accordance with the Decree of the Minister of State Owned Enterprises No.117 of 2002 and the SOE Act No.19 of 2003 related to the obligation to form audit committee and Decision of Board of Directors of Jakarta Stock Exchange No. Kep-305 / BEJ / 07-2004 relates to the obligation to have an independent commissioner of at least 30% of the total number of commissioners. Many studies in Indonesia use indicators of the proportion of independent audit committees and the proportion of independent commissioners in measuring corporate governance.

## **Ownership Structure**

Meckling and Jensen (1976) examine that the separation between ownership (and shareholders) and control (through management) naturally reduces incentives for management to maximize company efficiency. Ownership structure is often considered as an important instrument for corporate governance to address issues of conflict of interest between shareholders and company management. Policy makers, researchers and companies are concerned with whether and how the ownership structure can affect the company's performance.

Ownership structure has two dimensions: (a) ownership concentration and (b) identity of owner (Chen, 2011; Lee, 2008)). The ownership concentration provides information about the ownership rights of shareholders' capital, while the identity of the owner provides qualitative information about the character of shareholder. As the concentration of ownership (block holders) increases, according to Lee (2008), the incentives to improve the performance of the company and to monitor the running of the company is greater than that of the dispersed shareholders.

This research is based from the concern on the effect of foreign ownership, using the concept of ownership structure based on the identity dimension of the owner. Because what measured is the influence of foreign ownership, the measurement used is how much foreign ownership in the institution.

## **Profitability**

In measuring organizational performance, Kaplan and Norton (1992) use both financial and non-financial indicators as they result in a more thorough assessment of the business of an organization. Traditionally, however, performance measurements using many financial indicators have been carried out by researchers.

The financial performance of the organization, according to Brigham (2007), can be measured by, first, return on investment (ROI) / return on assets (ROA) ie the ratio between net profit after tax and total assets invested. Second, return on equity (ROE) ie the ratio between net profit after tax with total capital stock. Third, return on invested capital (ROIC), ie ratio of net profit after tax to total operating capital. Fourth, economic value added (EVA) is the operating income after tax minus total cost of capital. Fifth, market value added (MVA) is the difference between the stock market value of the company and the number of shares held by the shareholders.

Kwan (2003) mentions that the use of financial indicators in the assessment of banking performance is common for a period of time and the method can be used to compare the performance of one bank with other banks in the industry or with one sector of the industry. One used to measure company performance is profitability. Profitability Ratio is a ratio to assess the ability of companies in seeking profit within a certain period. This ratio also provides a measure of the level of management effectiveness of a company which is shown from the profit generated from the sale or from the investment income, one of which is reflected in the return on assets (ROA) (Kasmir, 2013).

## **Framework and Hypothesis**

- **The Influence of Corporate Governance on Profitability**

Healthy corporate governance affects the company's performance. Mishra and Mohanty (2014) confirm the positive influence of corporate governance on profitability. Makki and Lodhi (2014) found that corporate governance has an effect on financial performance that is profitability, but the influence is stronger if through the exploitation of intellectual capital resources. Meanwhile, Okiro et al. (2015) found that corporate governance in addition to direct influence on financial performance also influenced through the company's capital structure.

H1: Corporate Governance influential on profitability

- **The influence of Ownership Structure on Profitability**

Polovina and Peasnell (2015), Haque and Shahid (2016) and Arouri et al. (2014) found that ownership structure affects on the company's performance of profitability. Similarly Arouri et al. (2014) found that foreign ownership has a significant positive effect on banking performance in Qatar.

H2: Ownership Structure influential on profitability

## **Research Methods**

The method used is explanatory, i.e. research that aims to analyze the relationships between one variable with other variables or how a variable affects other variables. This study uses secondary data. The data used comes from the data and annual financial statements of manufacturing companies listed in the Indonesian Capital Market Directory (ICMD), [www.idx.co.id](http://www.idx.co.id) and the website of banking companies selected as research samples. The population in this study is a banking company listed on the BEI in 2008-

2015. The purposive sampling method is used in the sample selection so that obtained the sample of 28 banking companies with total observation of 224 data.

**Operationalization of Variables**

• **Independent Variable**

The independent variables in this study are corporate governance and ownership structure, as measured by the proportion of independent audit committees and the proportion of independent commissioners for corporate governance variables, and the composition of foreign ownership for ownership structure.

$$\begin{aligned} &\text{Proportion of independent audit committees} \\ &= \frac{\text{Number of independent audit committees}}{\text{Number of audit committees}} \times 100\% \end{aligned}$$

$$\begin{aligned} &\text{Proportion of independent commissioners} \\ &= \frac{\text{Number of independent commissioners}}{\text{Total Number of members of the Board of Commissioners}} \times 100\% \end{aligned}$$

$$\text{Composition of foreign ownership} = \frac{\text{The amount of stock ownership by foreign party}}{\text{Number of shares outstanding}} \times 100\%$$

• **Dependent Variable**

Dependent Variable of the research is profitability that measured by ROA (return on asset).

$$ROA = \frac{\text{Net Income}}{\text{Total assets}}$$

**Data Analysis Method**

- Classic assumption test which includes normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test.
- Multiple Regression Analysis
- Hypothesis Testing (Test t and Test F)

**Result and Discussion**

The results of normality testing with Kolmogorov-Smirnov test can be seen in the table below:

**Table 1 Kolmogorov – Smirnov test  
 One-Sample Kolmogorov-Smirnov Test**

		Unstandardized Residual
N		224
Normal Parameters <sup>a,b</sup>	Mean	.0000000
	Std. Deviation	.77062227
Most Extreme Differences	Absolute	.217
	Positive	.217
	Negative	-.111
Kolmogorov-Smirnov Z		1.684

Asymp. Sig. (2-tailed)	.070
------------------------	------

- a. Test distribution is Normal.
- b. Calculated from data.

Source: Data Processing by SPSS 20.00

Based on the output of SPSS version 20.00 presented in table 1 above, it appears that the value of  $Asymp.Sig > 0.05$ . It means that if based on criteria, the data in this research is normal distribution.

In this study used the value of Variance Inflation Factors (VIF) as an indicator of the presence or absence of multicollinearity among independent variables. The result of multicollinearity test is the value of Variance Inflation Factor (VIF)  $< 10$ , and tolerance value  $> 0.1$ . The results of multicollinearity testing can be seen in the table below:

**Table 2 Multicollinearity Test Result**

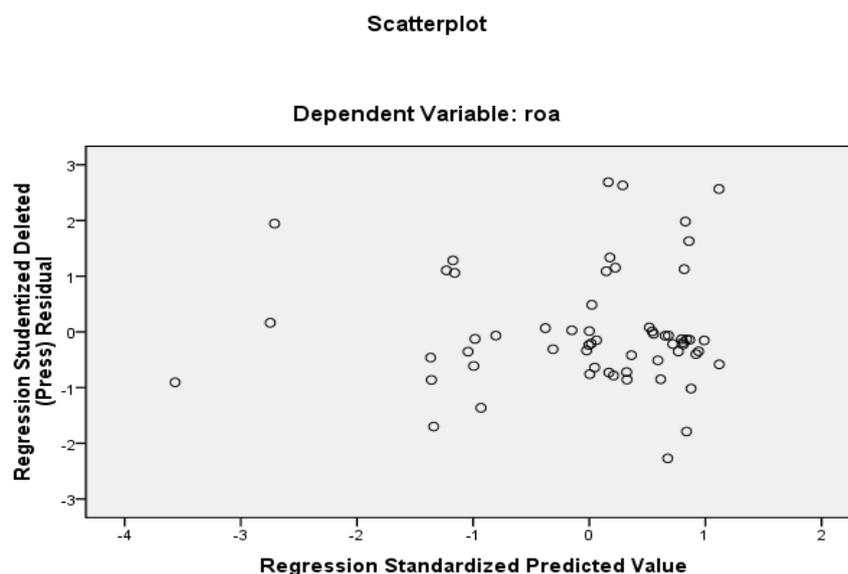
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	,779	4,457		,175	,861		
Komite Audit Independent	-1,684	3,678	-,033	-,458	,647	,864	1,157
Komisaris Independent	3,253	7,298	,031	2,446	,656	,940	1,064
KepemilikanAsing	,362	1,706	,016	2,212	,832	,833	1,200

a. Dependent Variable: Return OnAset

From the table 2 above it can be seen that the VIF value of the three independent variables ie Independent Audit Committee, Independent Commissioner and Foreign Ownership is 1.200, each Independent Audit Committee and Independent Commissioner less than 10 that is 1.157 and 1.064. And the tolerance value for the three X variables is above 0.1. So it can be concluded that there is no multicollinearity between independent variables.

The results of heteroscedasticity testing can be seen in the figure below:

**Figure 1 Heteroscedasticity Testing Result**



Source: Data Processing by SPSS 20.00

From Figure 1 on the scatterplots chart above shows that the points spread randomly and spread both above and below the number 0 on the Y axis. So it can be concluded that there is no Heteroscedasticity on the regression model, so that the regression model is worthy to be used to predict profitability ( ROA) based on input from variable of Independent Audit Committee, Independent Commissioner and Foreign Ownership.

The autocorrelation test results can be seen in the table below:

**Table 3 Autocorrelation Test Results**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.550 <sup>a</sup>	.3025	.212	8.97344	.002	.147	3	220	.932	1.327

a. Predictors: (Constant), KepemilikanAsing, Komisararis Independent, Komite Audit Independent

b. Dependent Variable: Return OnAset

Source: Data Processing by SPSS 20.00

Based on table 3 above, seen from the number of Durbin Watson that is equal to 2.007 it can be concluded that there is no autocorrelation due to the DW number.

While the analysis of determination coefficient is used to determine the effect of independent variables on the dependent variable. Coefficient of determination is a squaring of coefficient correlation multiplied 100%, which means percentage contribution of independent variables to the dependent variable.

By using SPSS 20.00 software obtained multiple correlation and coefficient of determination as can be seen in table 3 above which shows the coefficient of determination value R<sup>2</sup> of 0.550, meaning percentage contribution of Independent Audit Committee, Independent Commissioner and Foreign Ownership to Profitability (ROA) is equal to 30.25%, while the remaining 69.75% is influenced by other variables not included in this model .

To know the relationship between the Independent Audit Committee, Independent Commissioner and Foreign Ownership with Profitability (ROA) simultaneously it can also be done a multiple linear regression test as follows:

Based on table 2 above, then obtained the regression equation as follows:

$$Y = 0,779 - 1.684 X_1 + 3.253 X_2 + 0.362 X_3 + e$$

To know the simultaneous testing of the Independent Audit Committee, Independent Commissioner and Foreign Ownership with Profitability (ROA) can be seen in the table below:

**Table 4**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35,453	3	11,818	3,147	,932 <sup>a</sup>
	Residual	17714,980	220	80,523		
	Total	17750,433	223			

a. Predictors: (Constant), Foreign Ownership, Independent Commissioner, Independent audit committee

b. Dependent Variable: Return On Asset

Based on the results obtained from the computation of  $F_{count}$  with  $F_{table}$  is  $H_0$  accepted, because  $F_{count}$  (3.147)  $\geq F_{table}$  (2.26) which means that the Independent Audit Committee, Independent Commissioner and Foreign Ownership have a significant influence simultaneously on Profitability (ROA).

Hypothesis testing of the influence of Independent Audit Committee, Independent Commissioner and Foreign Ownership to profitability (ROA) partially, can be seen in table 2, where the  $t_{count}$  of Independent Audit Committee on Profitability (ROA) is equal to  $-0.458 < 1.96$ , so it can be concluded that there is no partial influence from the Independent Audit Committee on Profitability (ROA).

The results of this study are not in line with some previous research results. Mishra and Mohanty (2014) found that from 2 (two) of 3 (three) composite measures the implementation of corporate governance affects the company's financial performance as measured by its profitability (ROA). The two composites are Board Indicators consisting of independent Board of Commissioners, independent commissioners in independent audit committees, and Proactive Indicator in the form of availability of financial information. Meanwhile, Legal Indicator does not affect the financial performance of the company..

Meanwhile, the results of this study is in line with the results of Makki and Lodhi (2014) who found that the existence of corporate governance affect the financial performance through the efficient use of corporate intellectual capital. Moradi et al (2017) found that governance variables in the form of independent commissioners have a significant effect on company performance measured by ROA, ROE and ROS.

The value of t count of Independent Commissioner to Profitability (ROA) is equal to  $2.456 > 1.96$ , so it can be concluded that there is partial influence from Independent Commissioner to Profitability (ROA). While t count of Foreign Ownership of  $2.212 > 1.96$ , so it can be concluded that there is partially influence from Foreign Ownership to Profitability (ROA). Foreign ownership positively affects the financial performance of banks, especially in the form of profitability. However, the effect will decrease along with the increasing dominance of domestic shareholders in business control at the bank.

Meanwhile, the results of this study are not fully in line with Abraham (2013) who found that foreign ownership in the banking sector in Saudi Arabia affects the aggressiveness of banks in the management of its assets in the form of high levels of leverage as well as the greater lending provided to debtors. The results of this study found that foreign ownership affect the profitability measured by ROA indicates that foreign ownership has an effect on the efficiency of management of all existing assets in generating banking profit.

## Conclusion

Based on the results of the discussion it can be concluded that:

1. There is simultaneous influence from the Independent Audit Committee, Independent Commissioner and Foreign Ownership to profitability (ROA), with the influence of 30.25% while the rest of 69.75% is influenced by other variables not included in this model.
2. There is no partial influence from the Independent Audit Committee on Profitability (ROA), whereas Independent Commissioners and Foreign Ownership partially have an influence on Profitability (ROA).

## Recommendation

1. Control of concentrated ownership through arrangements can be an effective mechanism for maintaining corporate governance in countries with limited legal protection of investors. The non-

linear effect of the concentration of ownership on the performance of the firm indicates the possibility that the controlling shareholder may take over the wealth of the minority shareholders in the country. This suggests that there should be strict enforcement of regulations to curb the takeover by the controlling shareholder.

2. Companies should increase compliance with the application of governance factors by intensive control, which not only focuses on the independent proportion of audit committees and independent commissioners. Accountability is the key to providing adequate control and discipline for management. In addition it needs a better appreciation of the disclosure needs of the board of directors. The board of directors must ensure disclosure and transparency of information relating to the financial performance of the company, including when the company requires capital for investment or dividends.

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# EFFICIENCY AND DISCIPLINE STUDY OF GOODS DELIVERY FROM WEREHOUSE TO TANJUNG PRIOK PORTS

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**Abstract:** Human resources is one of the components of an existing system in an organization and are expected to provide good performance so that goals can be achieved organisasi. Nevertheless, human resources employees in this case are not always produce the expected performance by the organization. Several things affect the performance of the employees who need them are still not being met, lack of motivation were obtained both internally and externally, the limited number and or knowledge, or role and coordinate, yet can improve the timeliness of operational performance. In addition to these problems are also influenced by the supporting infrastructure is still not available up to organize the task function. With the operational performance of the employees that are still less then to realize good performance both internally and externally that have not been able to be implemented to the fullest .

Identify the Problem: Performance of operational employees in the company is still not optimal undergo shipping of goods to the port of Tanjung Priok, discipline is still low; Percentage of attendance rate in the corresponding entry timeliness working hours is still not as expected either in the warehouse or operational employees so that shipping of goods were to be effective and efficient, and yet right time; Duties and responsibilities beyond the scope of operational performance on the job making it less effective and efficient; lack of coordination with the parties – related parties resulting in delays the effectiveness of the delivery of goods; Traffic conditions are irregular, causing increasing levels of congestion which led to delays in delivery; communication between management and the trucking sometimes does not occur properly; compensation to operating performance, especially not in line with expectations.

Formulation of the problem: 1) Is there a relationship between the disciplines with operational performance in the port of Tanjung Priok? 2) Is there a relationship between the effisiensi of the delivery of goods to the operational performance in the port of Tanjung Priok? And 3) Is there a relationship between discipline and effisiensi of the delivery of the goods together with the operational performance in the port of Tanjung Priok?

Based on the hypothesis testing shows that there is a strong relationship between the significant and positive discipline with operational performance, thus the research hypothesis H1 is accepted where  $4.094 > t_{table} (1.701)$ , and the probability of significance  $0.000 < 0.05$ , and also supported with R Square of 0.374 or 37.4%. This shows the contribution of discipline relationship with operational performance by 37.4% while the remaining 62.6% is the influence of other factors such as promotion, competencies, compensation, and so forth is not examined. 2) Based on the hypothesis testing shows that there is a strong and positive relationship between the significant effectiveness of the delivery of goods to the operational performance, thus the research hypothesis H2 is accepted where  $5.712 > t_{table} (1.701)$  and the probability of significance  $0.000 < 0.05$ , and also supported by the R Square amounted to 0.538 or 53.8%. This shows the contribution of the relationship between work motivation and employee performance by 53.8% while the remaining 46.2% is the influence of other factors such as promotion, competencies, compensation, and so forth is not examined. 3) Based on the hypothesis testing and there is a strong relationship between the significant positive discipline and efisiensi of the delivery of the goods together with the operational performance, thus the research hypothesis H3 is accepted that of  $F(15,731) > F(3.354)$  and the probability of significance  $0.000 < 0,05$ , and is also supported by the R Square of 0.538 or 53.8%. This shows the magnitude of the contribution of the relationship between leadership style and motivation to work with the employee's performance at 53.8% while the remaining 46.2% is the influence of other factors such as promotion, competencies, compensation, and so forth is not examined.

## INTRODUCTION

Many companies are trying to establish a competitive advantage more quickly. They become turbo marketers and accelerate to the market. They apply turbo marketing in four areas: innovation, manufacturing, logistics and retail. Logistics is a general relation of goods which includes: the selection of the right type, the correct amount of accuracy, delivery to the right location, received at the right time, obtained at the right cost, delivery according to time and demand.

Logistics management is part of a supply chain management process that functions to plan, execute and control the efficiency and effectiveness of the flow and storage of goods, services and related information from the starting point to the point of consumption in order to meet the customers. Supply chain management to integrate suppliers, entrepreneurs, warehouses and other storage areas efficiently so that products are generated and distributed with the right quantity and timing to minimize costs and satisfy customer needs.

Efficient distribution is based on the use of appropriate transport methods in the delivery of goods to ensure a fast, economical and safe delivery of goods. The efficient use of vehicles is the goal of determining vehicle operating standards. This is the key for an operation with minimum cost. There are five areas in which the methods of study can be used to provide a basis for comparison. The five fields are Preparation of vehicles, Arrangement of goods in the vehicle, Time of vehicle operating and delivery of goods and Assessment of cargo.

In optimizing the use of land transportation, through logistics management and supply chain management from the warehouse to Tanjung Priok port we hope to minimize in terms of cost and time and quantity right in the delivery of goods from the beginning of the freight to the port of Tanjung Priok so that delivery of goods faster, Directed and precise. With efficiency in the delivery of goods makes the price of the product can be low which is a major contribution to the selling price of an item so as to meet the service to more consumers.

In the Study of Efficiency of Delivery of Goods from Warehouse to the research ports limit the problems that arise when in the delivery of Goods from Warehouse in Tangerang to Tanjung Priok Port and supporting factors that are interconnected by minimizing costs to be efficient.

## LITERATURE REVIEWS

According to Gaspers (2000: 27), Efficiency is a measure that shows how good resources are used in the production process to produce output. Efficiency is the characteristic of a process that measures the actual performance of a resource relative to a defined standard

Improvements in efficiency in both production and distribution processes will lower costs. According to Levitan and Wemere (2012: 215), efficiency can be understood as an activity of saving resources in organizational activities such as: saving of material use, electric power, water, money, time, fertilizer and so on.

Discipline is another characteristic of processes that measure the degree of achievement of output from the organizational system (Gaspers 2000: 27)

According to Hidayat 1986, a measure that states how far the target (quantity, quality and time) has been achieved. Where the greater the target presentation achieved, the higher the effectiveness

According to Sukono, discipline is a variety of rules that serve as guidance and guidance of community life in order to establish its existence in a safe, orderly and controlled by law in all aspects of life.

The initial pitch formulation of the basic transport model by Frank L. Hitchcock in 1941 formulating the problem of transportation as a method for the supply of goods from several factories to cities with fixed costs of delivery.

According to Charles A. Taff (1996) one of the costs that often involves the cost of warehousing and shipping costs is how to minimize the cost of distributing products from a number of sources to a number of objectives ... In using transport methods, initial solutions are developed and alternative solutions are evaluated so that optimum solutions can be solved. Initial solutions can be developed in one of several ways:

1. By having a solution that seems to be a good program
2. By using an existing program now
3. By starting from the upper left corner rather than the matrix and asserting the quantity until the requirements are met

According to H.M.N. Nasution (1996), transportation is defined as the transfer of goods and people from the place of origin to the destination. In this connection three things are seen:

1. There is a transported load
2. Available vehicles to transport
3. There is a passable path.

According to Jay Heizer and Barry Render (2005), transportation modeling is a recurring procedure for solving problems and minimizing the cost of shipping products from multiple sources to multiple destinations.

Martin (1998) defines management logistics as a process that strategically regulates procurement, transfer and storage of materials, components and storage of finished goods (and latest information) through the organization and its marketing network with certain ways so that profits can be maximized for the current and future periods through order fulfillment at cost effective.

According to The Council of Logistics Management, Logistics Management is a supply chain process that functions to plan, execute and control the efficiency and effectiveness of the flow and storage of service items and related information from the point of origin to the point of consumption, In its aim to meet the needs of its customers.

Ross (1998). Supply Chain Management is a management philosophy that continually seeks sources of competent business functions to be combined both within the company and outside the company just as business partners are in a single supply chain to pursue a highly competitive supply system and pay attention to customer needs, focusing on Developing innovative solutions and synchronizing the flow of products, services and information to create a unique source of customer value (costumer value).

Martin (1998), Supply Chain Management is an organization network that involves upstream and downstream relationships in different processes and assets that values in the form of products and services to customers.

Effectiveness is another characteristic of processes that measure the degree of achievement of output from the organizational system, (Gaspers, 1998).

According to Hidayat 1986, a measure that states how far the target (quantity, quality and time) has been achieved. Where the greater the target presentation achieved, the higher the effectiveness.

## **METHODOLOGY**

### **Time and place**

This research was conducted from April to August 2014 from preparation to preparing research report. The research location is from the werehousein Tangerang to the port at Tanjung Priok

### **Types of research**

This type of research is descriptive quantitative. Data collected is in the form of secondary data and primary data by using sofwere SPSS version 27.00

### **Samples and Sampling Techniques**

In this study, the sample used is the service users in the delivery. The number of samples in each research location is 100 people, which is considered to represent the number of users of transportation services in the efficiency of reaching 1000 people. Sampling technique is done by random sampling.

### **Method of collecting data**

Data collection methods used in this study are:

- 1) Observation is to observe directly the behavior of workers in the field in this case such as drivers, security officers, ticket guards in providing services to consumers.
- 2) Interviews are direct questions to the managers of transportation companies, and also to field workers in this case such as drivers, security officers, and users of freight services.
- 3) Questionnaire (questionnaire) made to see the efficiency in the delivery of goods.

**DISCUSSION AND RESULT**

**a. Hypotesis Tes(X with Y)**

**1) CorrelationTes**

H1 : There are correlation between effectiveness (X<sub>1</sub>) to delivery

$$r_{YX} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{\{n\sum X^2 - (\sum X)^2\} \{n\sum Y^2 - (\sum Y)^2\}}}$$

**Table 4.5**

**Correlationbetween X<sub>1</sub>: Efficiency Y: Delivery of goods**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.693 <sup>a</sup>	.480	.470	5.30446

Source: Data processed 2015

a. Predictors: (Constant), Dicipline

b. Dependent Variable: Delivery

The interpretation of the result of Product Moment Pearson correlation analysis shown in Table 4.5, between the effectiveness variable (X) and the delivery of goods (Y) has a positive relationship with the strong level shown by the r value of 0.693.

$H_0 : \rho = 0$  (There is no correlation between discipline and delivery).

$H_a : \rho \neq 0$  (There is a connection between the delivery of goods).

The significance of the correlation coefficient at the level of  $\alpha = 0.05$  is indicated by the value of t-test

$$t\text{-test} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.693\sqrt{57-2}}{\sqrt{1-693^2}} = 7,011 > t_{\text{tabel}} = t_{0.025;57} = 2,021$$

and with a probability significance of  $0.000 < 0.05$  then Ho is rejected, this indicates a positive relationship between Efficient with the delivery efficiency is significant or statistically significant. Based on the results of this test, the hypothesis of research that states there is a significant relationship can be accepted.

a) There is influence of discipline intensity (X) on delivery of goods (Y).

In connection with the above, then the hypothesis to be tested in the study are as follows:

a. Significance Test of Regression Parameters

$H_0 : \rho = 0$  (There is no influence X: discipline against Y: delivery)

$H_a : \rho \neq 0$  (There is influence X: discipline to Y: delivery).

From result of analysis of regression test with dependent variable of discipline and independent variable of goods delivery, as shown in table 4.6

**Table 4.6**  
**The Influence of RegretionCoefficientX: diciplineto**  
**Y:delivery goods**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	19.096	6.117		3.122	.003
Dicipline	.697	.098	.693	7.124	.000

Source: Data processed 2015

From Table 4.6. The above shows that the regression model with a significance value of 0.000 <real level (0.05), indicates the model is significant. This means the accepted research hypothesis (Ha).

Based on Table 4.6 also shows the value of constant a (intercept) of 19.096 and regression coefficient b (slope) X: discipline of 0.697 thus obtained a simple linear regression mathematical equation to express the effect of X: discipline to

Y: delivery of goods:

$$\hat{Y} = 19,096 + 0,697 X_1$$

The interpretation of the regression equation is as follows:

- 1) The constant value of 19.096 shows the delivery of goods (Y) of 19.096 if the X value of discipline is assumed to be fixed.
- 2) The value of the regression coefficient (slope) of 0.697 shows the magnitude of the effect of X: the discipline on delivery (Y) is positive, if the X: disciplinary value rises 1 unit, -, then Y: the goods delivery will rise by 0.697.

Information:

1. If there is no disciplinary effect on the delivery of goods then the scores of goods submission of 19.096
2. If the discipline score is one then the delivery score becomes 20,096
3. If the discipline score is two, then the delivery score becomes 21,096.

$$\hat{Y} = 19,096 + 0,697 X_1$$

The strength of the relationship between efficiency (X1) and the delivery of goods (Y) can be shown by the correlation coefficient  $r_{y1}$  of 0.693; And test results of significance of correlation coefficient between variables are seen in the following table

b) Coefficient of Determination

Then the magnitude of the discipline in explaining the delivery variable is measured by the coefficient of determination shown in Table 4.12 as follows:

**Table 4.6**  
**Coeffisien of Determination dicipline toDelivery**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.693 <sup>a</sup>	.480	.470	5.30446

Source: Data processed 2015

- a. Predictors: (Constant), Dicipline
- b. Dependent Variable: Delivery

In Table 4.6 shows the correlation coefficient  $r$  value of 0.693 and  $r^2$  value of 0.480 means the contribution of disciplinary variables in explaining productivity variability of 48% and the remaining 52% is explained by other variables not included in the model. Thus the effect of discipline on delivery is dominant, although there are still other variables or factors that influence the delivery of goods

**b. Hypotesis Tes(X<sub>2</sub>with Y)**

**1) CorrelationTes**

H2 : There are correlation between service (X<sub>2</sub>) with productivity (Y).

$$r_{YX} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{\{n\sum X^2 - (\sum X)^2\}\{n\sum Y^2 - (\sum Y)^2\}}}$$

**Table 4.7**  
**Correlationbetween X<sub>2</sub>dicipline Y: delivery**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.675 <sup>a</sup>	.455	.445	5.42974

Source: Data processed 2015

- a. Predictors: (Constant), dicipline

Interpretation of Product Moment Pearson correlation analysis shown in Table 4.7 between service variables (X2) and delivery of goods (Y) has a positive relationship with the strong level indicated by the  $r$  value of 0.675.

$H_0 : \rho = 0$  (There is no relationship between discipline and delivery).

$H_a : \rho \neq 0$  (There is a relationship between discipline and delivery).

The significance of the correlation coefficient at the level of  $\alpha = 0.05$  is indicated by the magnitude of

$$t_{-uji} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.675\sqrt{57-2}}{\sqrt{1-0.675^2}} = 6,784 > t_{-tabel} = t_{0.025;15} = 2,021$$

and with a probability significance of  $0.000 < 0.05$   $H_a$  is accepted, this indicates a positive relationship between Discipline with the delivery of goods is significant or statistically significant. Based on the results of this test, the hypothesis of research that states there is a significant relationship can be accepted.

a) There is a discipline effect (X2) on delivery (Y2).

In connection with the above, then the hypothesis to be tested in the study are as follows:  
 Significance Test of Regression Parameters

$H_0 : \rho = 0$  (No effect X2: discipline against Y: delivery)

$H_a : \rho \neq 0$  (There is influence X1: discipline to Y: delivery).

From result of analysis of regression test with dependent variable of discipline and independent variable of delivery, as shown in table 4.14.

**Table 4.14.**  
**Influence of RegretionCoefficient X<sub>2</sub>: diciplineto**  
**Y: delivery**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	10.549	7.683		1.373	.175
Services	.828	.122	.675	6.777	.000

1. Dependent Variable:  
 dicipline  
 Delivery

Source: Data processed 2015

From Table 4.14 above shows that the regression model with a significance value of  $0.000 < \text{real level } (0.05)$ , shows the model is significant. This means the accepted research hypothesis ( $H_a$ ).

Based on Table 4:14 it also shows the value of constant a (intercept) of 10.549 and regression coefficient b (slope) X2: service of 0.828, thus obtained a simple linear regression mathematical equation to express the effect of X2: discipline to Y: delivery of goods.

$$\hat{Y} = 10,549 + 0,828 X_1$$

The interpretation of the regression equation is as follows:

1. The constant value of 10.549 shows the delivery (Y) of 10.549 if the X2: value of discipline is assumed to be fixed.

- The value of the regression coefficient (slope) of 0.828 shows the magnitude of the effect of X2: the discipline on delivery (Y) is positive, if the X2: discipline value rises 1 unit, -, then Y: the delivery will rise by 0.828.

Figure 4.5 Graphic of discipline relationship with delivery

Information:

- If there is no disciplinary effect on the delivery then the penirman score of 10.549
- If the discipline score is one then the delivery score becomes 11,549
- If the score discipline is two, then the delivery score will be 12,549.

$$\hat{Y} = 10,549 + 0,828 X_2$$

The strength of the relationship between service and produktivitas can be shown by r<sup>2</sup> correlation coefficient of 0.675. Significant test results correlation coefficient between variables are shown below.

b) Coefficient of Determination

Then the amount of service contribution in explaining productivity variables measured by coefficient of determination shown in Table 4.7 as follows:

**Table 4.7**

**Coefficient of discipline determination to Delivery of Goods**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.675 <sup>a</sup>	.455	.445	5.42974

Source: Data processed 2015

a. Predictors: (Constant), discipline

b. Dependent Variable: delivery of goods

In Table 4.7 shows the correlation coefficient r value of 0.675 and r<sup>2</sup> value of 0.455 means the contribution of the disiplin variable in explaining the variability of the sender of 45.5% and the remaining 54.5% explained by other variables not included in the model. Thus the influence of discipline on delivery is quite dominant category, because there are still other variables or factors that influence it more.

**d. Hypotesis Tes( $X_1$  and  $X_2$  to Y)**

**1) Multiple correlation coefficient analysis**

Correlation coefficient is used to find out how strong the relationship between independent variables with dependent variable. Here are the results of data processing in Table 4:16. below this :

**Table 4.8**  
**Correlation Coefficient Results**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.770 <sup>a</sup>	.593	.578	4.73568	1.870

a. Predictors: (Constant), efisiensi, Disiplin

b. Dependent Variable: delivery

Source : data processed 2015

The interpretation of the result of Product Moment Pearson correlation analysis shown in Table 4.8 between the efficiency ( $X_1$ ) and discipline ( $X_2$ ) variables with the delivery of goods (Y) has a positive relationship with the strong level indicated by the r value of 0.770. It can be interpreted that the relationship between efficiency ( $X_1$ ) and discipline ( $X_2$ ) is positive or unidirectional which means efficiency improvement ( $X_1$ ) and discipline ( $X_2$ ) will increase delivery (Y).

**2) Analisis Koefisien regresi berganda**

To analyze the effect of efficiency ( $X_1$ ) and discipline ( $X_2$ ) on delivery (Y), the authors use regression analysis technique with the help of SPSS computer program. Based on data processing, obtained multiple regression results in the form of the following table 4.9.

**Table 4.9**  
**Results of Multiple Linear Regression Analysis**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	2.307	6.972		.331	.742
Efficiency	.458	.107	.455	4.278	.000
Discipline	.506	.131	.412	3.874	.000

a. Dependent Variable: delivery

Source : data processed 2015

Based on the results of multiple regression analysis above, it can be obtained a regression line equation as follows:

- The constant a of 2.307 states that if the variables  $X_1$  and  $X_2$  are constant, then the variable Y is 2.307.
- The regression coefficient of  $X_1$  states that each addition (due to positive sign) one unit of variable  $X_1$  (efficiency) will increase the Y variable (delivery) by 0.458 assuming another independent variable of the constant.
- The regression coefficient of  $X_2$  states that every addition (due to positive sign) one unit of variable  $X_2$  (discipline) will decrease the variable Y (pengiriman) by 0.506 assuming another independent variable of constant magnitude.

## CONCLUSION AND RECOMMENDATION

From the test result of the three proposed research hypotheses proved that the effectiveness variable (X1) and the discipline variable (X2) either individually or jointly have influence on the delivery of goods from warehousing in Tangerang to Tanjung Priok Port (Y). This conclusion can be summarized as follows:

1. The effectiveness variable has a significant positive effect on the delivery discipline of goods from warehousing to Tanjung Priok Port. Based on the calculation results obtained that the closeness of the relationship is shown with a correlation coefficient of 0.612 while the coefficient of determination of discipline on the effectiveness of goods delivery from warehousing to Tanjung Priok Port is 0.374. So it can be concluded that the higher the discipline given the higher the operational performance of the delivery of goods from the warehouse to the Port of Tanjung Priok, this is also supported by the hypothesis of research where there is a significant positive influence discipline of the potential delivery of goods from the warehouse to the Port of Tanjung Priok, with So hypothesis research H1 accepted or  $t_{count} > t_{table}$  ( $4,094 > 1,701$ ).
2. Effectiveness variables have a positive influence on the high potential of goods delivery from the warehouse to the Port of Tanjung Priok. Based on the calculation results obtained that the closeness of the relationship is shown by the correlation coefficient of 0.734 while the coefficient of determination effectiveness on the operational performance of goods delivery from the warehouse to the Port of Tanjung Priok is 0.538 This value means that the contribution of effectiveness to the rise of the potential delivery of goods from the warehouse to the Port of Tanjung Priok Is 53.8%. So it can be concluded that the more tiered with effective effectiveness given the higher the potential delivery of goods from the warehouse to the Port of Tanjung Priok, this is also supported by the hypothesis of research where there is a significant positive effect on the effectiveness of the potential delivery of goods from the warehouse to the Port of Tanjung Priok , Thus the hypothesis of H2 research is accepted or  $t_{count} > t_{table}$  ( $5,712 > 1,701$ ).
3. Variable discipline and effectiveness of delivery of goods together have a significant positive effect on the operational performance of goods delivery from the warehouse to the Port of Tanjung Priok. Based on the calculation results obtained that the closeness of the relationship is shown with a correlation coefficient of 0.743 while the discipline determination kofisiensi on the operational performance of goods delivery from the warehouse to the Port of Tanjung Priok is equal to 0.538. So it can be concluded that if the efficiency and discipline of container shipment are jointly improved then the results in the delivery of goods from the warehouse to the Port of Tanjung Priok will increase, it is also supported by the research hypothesis where there is a multiplier significant influence discipline and delivery effectiveness against the potential in Delivery of goods from the villas to the Port of Tanjung Priok, thus the hypothesis of H3 research accepted or  $F_{count} > F_{table}$  or  $15.731 > 3.354$ .

From the results of the research discussion, conclusions and research implications as described above, it is recommended as follows:

1. In terms of discipline, the human resources department through its staff needs to have managerial experience through direct company review in order to know clearly how problems managers face in terms of human resources.
2. In terms of delivery efficiency, it is necessary to foster a harmonious relationship between the warehouse, the operational department and the vendor of both shipping and trucking. This is necessary to motivate employees in carrying out their duties and responsibilities. So the results obtained more leverage both quality and quantity
3. To further improve the performance of employees it is necessary to the training process how the work done can run smoothly and cooperate well and correctly.
4. With the holding of trainings and training is expected to improve the knowledge and development of employees who can complete in a timely, effective and efficient and SOP so as to contribute to the company and management company can provide assessment or performance for employees by providing Well-being compensation, facilities and promotion positions.

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# Specialized Physician Shortage in Rural Communities

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**Abstract-** The shortage of physicians in rural America has been an ongoing topic for decades. Most scientific literature has addressed the lack of primary care physicians in rural areas. However, there is a substantial amount of data which also shows a scarcity of specialty physicians in these regions. This shortage of specialized doctors has not been as represented in scientific research. Certain demographics in rural areas reveals the need for specific care which can only be provided by specialized physicians. The purpose of this article is to identify the current state of healthcare in rural areas and to identify solutions needed to increase specialized care in rural and underserved communities. This paper will serve as an excellent example not only to medical professionals and medical management teams, but also for legislatures approving the local and federal laws in the United States of America.

**Index Terms-** Specialized physicians; Rural Areas; Level 1/2 trauma centers; Physician Shortage.

## I. INTRODUCTION

Within the last decade there has been a population decline in rural areas due to two main factors; negative net migration (more emigrants than immigrants) and natural decrease (deaths exceeding births). Negative net migration resulted from a lack of job opportunities, undeveloped cities, a shortage of economic and technological resources, and an unattractive lifestyle. These factors caused individuals who resided in rural areas to move to the cities in search of a better life and more opportunities. However, new research and data shows that the population shift may soon be going in the opposite direction. According to the Economic Research Service of the United States Department of Agriculture (USDA), the data from the U.S. Census Bureau demonstrates an increase in net migration in rural areas and the natural decrease has changed to a natural increase from 2013 to present (Cromartie, 2017). The USDA states "If current trends continue, both net migration and natural increase will contribute to a recovery of population growth in rural and small-town America in the coming years" ("Five Years", 2016).

Several factors have influenced the USDA to give a positive outlook on the population growth for rural areas. One of the main influences on the positive net migration is the decrease in unemployment in the rural communities. The USDA states that the rural communities' unemployment rate is on the decline from 9.9% in 2010 to 5.7% in 2015 ("Rural America at a Glance", 2016). The poverty rate in the rural areas are also decreasing. The rural areas showed a poverty level decrease of

0.9 %, compared to a poverty decrease of 0.8% for urban areas ("Rural America at a Glance", 2016). With unemployment and poverty on the decline, growing rural communities will be a viable option for people to live in. As these rural towns grow and expand there will be a need for more doctors in these areas, which are already dealing with a shortage of physicians.

## The at Risk Rural Population

In the rural areas of America, there are specific demographics that place the population in an at risk category for many health conditions. According to the United States Census Bureau, the median age for people living in rural America is 51 years old compared to a median of 45 years old for their urban counterparts ("Measuring America", 2016). This age disparity can lead to more patients in rural areas requiring medical care as risk factors for certain diseases increase with aging. In fact, the National Rural Health Association reports that rural areas have more incidences of diabetes and coronary artery diseases than non-rural areas ("National Rural", 2017). Also, the percentage of older adults taking prescription medication is higher than their younger counterparts. According to the United States Census Bureau, 80% of adults 65 years or older reported regularly taking prescription medication, compared to 35% of adults younger than 65 years ("Americans Are", 2012). The Census Bureau also states that hospital stays among adults were higher for patients who were older than 65, at 83%, when compared to 8% for the rest of the population ("Americans Are", 2012). The mean age of the rural population is 6 years older, and statistics show that the older population is at risk for more diseases and ailments when compared to the younger population. These statistics along with the fact that there are more incidences of diabetes and coronary artery disease in rural areas, supports the standing correlation between age and risk for disease which plague this population.

Another factor to be considered is the lack of reliable transportation systems and internet connection in rural areas. According to the National Rural Health Association, the residents of rural areas have difficulties reaching healthcare providers due to a lack of public transportation, and having to travel longer distances to healthcare facilities ("National Rural", 2017). The association also reports that 53% of rural Americans lack the 25 Mbps/3 Mbps of bandwidth, which is the benchmark for internet speed according to the Federal Communications Commission ("National Rural", 2017). Lack of adequate internet speed can make it difficult for the citizens to receive health information via internet websites and other services such as telehealth. Without adequate internet speed and/or connection, it is important that there are a sufficient number of doctors to make

up for the lack of communication and health education that is facilitated through stable internet connection.

Injury related ailments and deaths are also a topic of concern in rural areas. More than 50% of vehicle crashes occur in rural areas ("National Rural", 2017). There is also a 22 % increase of injury related death in these areas ("National Rural", 2017). Primary care physicians are not usually trained to handle injuries related to the more complicated traumas such as fractures, torn ligaments, head trauma, nerve damage and vascular lacerations which are presented by car accident victims. Another alarming statistic is that the rural population is more at risk than the urban population for the five leading causes of death in America. According to the CDC, from 1994 to 2014, the rural areas had higher incidences of death from heart disease, cancer, chronic lower respiratory disease, cerebrovascular accident (stroke), and unintentional injuries (Phillips, 2017). All of these ailments will require interventions or consultations from specialty doctors; these doctors include but are not limited to cardiologists, oncologists, invasive oncologists, pulmonologists, neurologists and trauma doctors. The lack of primary care physicians in America has been an ongoing topic, but the statistics mentioned above stress the need for specialty doctors in the rural areas.

## II. PRESENTATION & STATISTICAL DATA

According to the North Carolina Medical Journal, 19.8% of the population lives in rural areas, while only 8.9% of physicians practice medicine in these areas (Heck, Currie & Fagan, 2017). Furthermore, there are 380.5 physicians per 100,000 people in urban areas, compared to 118.3 physicians per 100,000 people in rural areas (Heck et al., 2017). The shortage of primary care physicians has been discussed several times over, with many initiatives to bring more of these doctors to rural areas. However, there hasn't been much discussion regarding the specialty physician shortage in rural areas. The National Rural Health Association states that there are 30 specialty physicians per 100,000 people in rural areas compared to 101 primary care physicians per 100,000 in the same areas (National Rural, 2017). Therefore, although there has been an emphasis on the shortage of primary care physicians, more attention should be given to the shortage of specialty physicians in rural areas. The Association of American Medical Colleges (AAMC) 2016 specialty data report showed that the specialties with the highest percentages of active physicians practicing in the same state where they trained were child and adolescent psychiatry (57.8%), family medicine/general practice (56.0%), and psychiatry (56.0%) (AAMC, 2016). The specialties with the least percentages were thoracic surgery (30.4 %), neurological surgery (33.6%), and plastic surgery (33.6%) ("Physician Specialty", 2016). So, not only is there a shortage in rural areas of specialty physicians, but specialty physicians are less likely to stay in the state where they trained. In other words, primary care physicians who complete residencies in rural areas will most likely stay in these areas, while certain specialty physicians will most likely practice elsewhere. Regarding the future outlook of the shortage of surgeons, which are much needed in the rural areas, the Journal of the American Medical Association states that the annual physician workforce indicates a shortage of surgical

specialties of 19,800 to 29,000 physicians by 2030 (Kirch & Patelle, 2017).

With more than 50% of vehicle crashes occurring in rural areas, and a higher incidence of death by unintentional injuries, the rural areas are especially in need of trauma centers. The parts of the United States that suffer the most from lack of specialty care which is provided at level 1 or 2 trauma centers are states in the western and midwestern regions. According to Traumamaps.org, the states lacking the most in these services are Utah, Nevada, Wyoming, Idaho and Montana ("Traumamaps," 2017). The website map displays the scarcity of level 1 or 2 trauma centers, showing many areas without these centers for miles. For example, going from west to east traveling through Utah and Nevada, there is over 400 miles without any level 1 or 2 trauma centers that are within 60 minutes distance via ambulance.

The American College of Surgeons Health Policy Research Institute (ACSHPRI) shows the distinction between the urban and rural counties in each state, revealing that these aforementioned states are mostly rural based on the percentage of rural counties vs. percentage of urban counties. Statistics from ACSHPRI show that Utah consists of 65% rural counties, Nevada 76%, Idaho 73%, Montana 75%, and Wyoming 91% ("American College," 2012). These same states have the least amounts of trauma centers, which correlates negatively with the higher incidence of injury related deaths. Traumamaps.org displays the amount of injury related deaths per 100 thousand people, which reveals a negative correlation between the availability of level 1 or 2 trauma centers and incidences of injury related deaths in these rural areas ("Traumamaps," 2017).

The rural communities will be hit the hardest by the projected shortage of surgical specialties since there is already a severe shortage of surgeons in these areas. For instance, the ACSHPRI states that Utah has a total of 29 counties, 19 of these are rural counties; of these 19, only 1 county has 45 surgeons per 100,000 people, and 9 counties have 0 surgeons per 100,000 people ("American College," 2012). None of these rural counties have a neurosurgeon, and within the whole state of Utah, there is an average of 1.48 neurosurgeons per 100,000 people ("American College," 2012). Other states such as Idaho, Wyoming, Nevada, and Arizona all have under 2 neurosurgeons per 100,000 people ("American College," 2012). There is also a deficit in vascular surgeons in these states, they all have under 1 vascular surgeon per 100,000 people, with the exception of Wyoming, which has 1.06 vascular surgeons per 100,000 people ("American College," 2012).

### Factors Contributing to Physician Shortage in Rural Areas

There are several reasons why there are less doctors coming to and staying in rural areas. The most notable reason is the deficiency of medical schools in rural areas. If students from rural areas have to go to urban areas for medical school, they are less likely to choose a residency in the rural area after doing clinical rotations in the urban areas. According to PBS.org, the state of Arkansas has one of the fewest physicians per capita and among the unhealthiest residents (Stateline, 2016). This correlates with the fact that Arkansas only has two medical schools per state. Another factor is the lack of residencies in the rural areas. This is due in part to the size of the hospitals in the

rural areas vs the urban areas. Larger hospitals in the big cities will require more residents to treat patients. Unfortunately, there has been a freeze on the cap for government funding for new residency spots nationwide. So, until this cap is lifted, and the government provides funding to the residency training programs, there won't be many new residency programs to train doctors in rural areas. The bigger more prestigious hospitals in the city generate more revenue, and can afford to have more residency spots open to pay the residents to train; however, the smaller hospitals in the rural areas are more dependent on government funding to finance residency programs. After training in residency for at least 3 years doctors have already begun to settle into working fulltime and creating a life in the city they do residency, and are less likely to leave. So, doctors who go to medical schools in urban areas and complete residencies in urban areas are likely to stay in the urban areas for the duration of their careers.

There are however, medical schools and residencies in rural areas that are appealing to future doctors; so why aren't doctors staying in the rural areas upon completion of residency? The most notable reason is a lack of developed infrastructural systems in the rural communities. The small rural towns of America are less developed, with a lack of roads and highways, which can make traveling difficult. The lack of access to markets, shopping malls, recreational centers, restaurants and social gathering areas can be unappealing to a physician looking to establish his/her career. The lack of technological advances in the rural area is also a reason that would deter doctors from practicing in the rural areas. Telehealth is now becoming a huge part of medicine due to the efficiency it adds to being able to communicate with and treat patients. Not only is it helpful to physicians, but it also aids patients to keep in contact with physicians, and keep up to date with follow up appointments among other things. But as previously mentioned in this article, many areas in the rural communities are without sufficient internet connection; this interruption in internet communication can be a hindrance to maintain patient-doctor relationships and be an additional hurdle to jump over when treating patients.

The existing shortage of doctors in rural towns could mean that a rural doctor will be seeing more patients, because he/she will likely be the only doctor available to many patients. The higher the patient to doctor ratio could also mean that there will be a higher workload which could lead to burnout. In fact, specialists who practice in rural areas will be dealing with ailments outside of their scope of practice. This is because there won't be much other specialists to refer the patients to. The specialty of OB/GYN is one that is declining in rural areas. The Journal of Family Medicine Obstetrics states "Due to this lack of OB/GYN interest in practicing in rural areas, the primary medical physicians in these areas, which tend to be family physicians, should assume obstetrical care for these patients" (McCaleb & Wheat, 2013). This is an example of how lack of specialty care in the rural areas will spill over and burden the physicians with conditions outside of their scope of practice. This dilemma can and will deter physicians from practicing in rural areas.

Besides the possible burdens of work, one settling down in an area to make a living has to consider life outside of his/her career. Rural areas are often more attractive to the older

population, those who are retired and looking for a slower and relaxed life. Physicians completing residency are far from retiring, and the lifestyle of rural areas may not be appealing to those who are looking to start a life and family. Lack of places to go and things to do are a big factor in the unappealing status of the rural areas. For those with a family and/or children, lack of diversity in people and cultures of rural areas may deter physicians from staying in rural areas as well. When choosing a place to live, things to consider would be the amount of schools in the district for one's children, the distance from local supermarkets, and the ease of access to areas which would be frequently visited. Rural areas have less movie theaters, restaurants, and events that allow for a work and social life balance, when compared to the urban areas of America.

### **Suggestions and Possible Solutions**

In order to solve the specialist physician shortage in rural areas, the issue must be addressed as two separate problems. First, the physician shortage in rural areas must be addressed as a general issue, then an emphasis must be placed on the shortage of specialty doctors. The most notable change that can be made to bring more doctors to rural areas would be to increase the amount of medical school admissions in these areas. This is because the doctors who are graduating from medical schools in these communities may acclimate to life in the rural areas and want to stay. This solution has been thought of before and implemented, but to no avail. Medical schools have increased admission by 25% since 2002, but there has been no significant change in the shortage since there has been no notable increase in the residency slots in America since 1997. Thus, a better answer to this problem would be to increase the federal aid in funding residency slots for hospitals, particularly in rural areas. According to the AAMC, there is a proposed bill called Training Tomorrow's Doctors Today Act that would provide the financial support from the federal government to enable the hospitals to train an extra 3,000 doctors per year ("GME Bill", 2016). This bill is a possible solution to the shortage, but it is still awaiting approval from Congress. Our suggestion would be to present the data from this article, along with other sources to the state senators, DOH and ACGME to paint a clear picture of where the healthcare system is heading. This research shows that it is only a matter of time until the rural areas of America are hit with a health crisis due to a lack of physicians. Hospitals and facilities must be transparent with the issue of understaffing, and show the correlation between high patient to doctor ratio and medical errors. Also, the people of these communities which face shortages must be made active in the process of persuasion to congress. Surveys and interviews can be performed to discuss issues such as wait times in doctor's office, lack of access to doctors in the immediate area and inability to have preferences when choosing doctors. All of these situations are related to physician shortage, which can be mitigated by opening up the cap for funding for residency slots. Along with new residency openings, the demographics for the rural areas must be presented to hospitals and institutions to allocate the appropriate specialty residencies in the at risk areas.

Another intervention that can be implemented is to open more level 1 and/or 2 trauma centers in rural areas. The higher incidences of injury related deaths in the rural areas are related to

the lack of trauma centers. Trauma centers can be affiliated with university hospitals so that medical students and residents can be trained in management and care of traumatic injuries in order to be well versed at dealing with these ailments. An increase in the number of trauma centers can also lead to jobs for physicians which will be an incentive for doctors to stay in rural areas.

Physicians such as cardiologists, endocrinologists and gastroenterologists are primary care physicians who further their education and training through fellowships to become specialized in a specific area. The benefits of having these doctors is that they have a foundational training in primary care, along with specialized training. So, a suggestion would be to increase the number of fellowship training in the rural areas. A pay increase to the physicians who chose fellowships in areas that would treat at risk patients in the respective community could also be allotted. As previously stated in the article, rural areas are at higher risks for chronic lower respiratory disease, cancer, heart disease, CVA and unintentional injuries. Out of these five ailments, four of them can be treated by a primary doctor who completed a fellowship; these specialties are cardiologists, pulmonologists, oncologists and physiatrists. Also, there are dual residency programs such as internal medicine/emergency medicine and anesthesiology/ emergency medicine which provide physicians with two certifications. Physicians with multiple certifications are valuable when treating patients in trauma centers, because they can treat more patients with different ailments than physicians with one specialty.

Attracting doctors to rural areas is another way to fix the physician shortage. There are two possible approaches. One way is to advertise and endorse working in rural hospitals and communities, and the other way is to advertise the positive aspects of living in rural areas. As a healthcare provider in the rural community, there are various benefits that can make the career worthwhile. For instance, there are several loan forgiveness and scholarships programs for health care practitioners who practice medicine in rural areas. One program is the Health Professions Loan Forgiveness Program; this program is eligible to healthcare practitioners who practice medicine in a designated shortage area. The program allocates up to \$100,000 in education loan assistance for physicians who practice medicine in designated areas such as Wisconsin, which has a lack of specialty physicians. With a majority of physicians graduating medical school with an enormous amount of debt, this program is an incentive to come to and stay in rural areas. These programs must be emphasized when advertising the benefits of practicing in rural areas.

Another benefit is the lower cost of living when compared to urban areas. Urban areas such as New York City, Chicago and Los Angeles are experiencing an increase in cost of living. This could be too expensive for a medical school graduates with over 100,000 dollars in student loans. According to BLS.gov, urban households spent 18% more than rural households; which consisted of expenses on food, housing, apparel and education (Hawk, 2013). The main expenditure difference between rural and urban areas was the cost of housing. Houses in urban areas have an average market value of \$153,147 when compared to \$129,111 for rural areas (Hawk, 2013). The cost to rent per month in an urban area is \$699 per month compared to \$354 per month in rural regions (Hawk, 2013). The loan forgiveness

programs combined with the cheaper cost of living in rural areas can be a great way to attract doctors to rural areas and keep them there.

Another benefit to practicing medicine in a rural area is the ability to form more personal relationships with one's patients. Rural areas offer a more close-knit community when compared to urban areas. Doctors often know their patients very well, and are more respected within the community as a professional of high status when compared to doctors in urban areas. For physicians who entered medicine with a passion for impacting lives on a more personal level, rural communities may be a more favorable option.

Attracting specialized physicians to rural areas can be difficult, because the rural areas lack the population size that urban cities provide for a more profitable practice. Also, the hospitals and facilities are usually older and less up to date with medical technology that some specialties require, such as the newest operating utensils which make surgeons' jobs easier. These factors can be overlooked by specialists when the data displaying the lack of specialties are made available and aware to these physicians. The data showing the correlation between lack of specialists in the rural areas and the increase in morbidities and deaths can be an incentive for these physicians to go where they are needed.

### III. CONCLUSIONS

The current notion regarding the physician shortage focuses on the lack of primary care doctors in rural areas; although this is true, this article has displayed multiple examples of research and statistics which shows that specialty physicians are also needed in these rural areas. Not only is there a shortage, but the rural area's population presents with specific demographics which makes this shortage especially concerning. Along with the demographics of the population, there are complex living conditions in rural areas that make it imperative to have the right types and adequate amount of doctors to provide care for this population. Upon implementation of the proposed strategy, the rural and underserved communities will not only get a better reputation in the healthcare system, but a better patient outcome and recognition within current and graduated medical students pursuing residency in the United States.

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# Workplace Coaching and Self-Actualization in the European Union, North America, and post-USSR countries

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**Abstract-** Coaching is increasing in popularity. Studies have found positive correlations between coaching and employees' performance, job satisfaction, self-efficacy, and leadership (e.g. Elliger, Elliger, & Keller, 2003; Wales, 2013). However, the relationship between coaching and self-actualization is not well understood. In addition, little is known of cultural differences in coaching. The success of an organization is connected with employees' well-being, self-actualization, and their individual needs to develop their full potential (Maslow, 1970). Therefore, understanding the relationship between coaching and self-actualization may be critical to a company's success. The purpose of this study was to determine if there is a correlation between workplace coaching and self-actualization, and to investigate if there are significant differences between coaching and self-actualization across countries (European Union, North America, and post-USSR countries). The study used a convenient sample of 135 adults who currently reside in the European Union, North America, or post-USSR countries. The survey was conducted anonymously through the Internet, and participants were asked to answer a researcher-developed questionnaire about their workplace coaching experience, and their level of self-actualization, as well as some demographic information. This study found no significant correlation between workplace coaching and self-actualization. However, statistically significant difference between workplace coaching and self-actualization across countries was found. In other words, the cultural background of each employee, and their differences play an important role in the workplace management, and the effectiveness of performance depends on the proper application of management skills in regard to cultural dimensions.

**Index Terms-** coaching, workplace coaching, self-actualization, culture, organizational culture, cross-cultural comparison

## I. INTRODUCTION

Progress in information technology, transportation, and the process of globalization has led to a more interrelated and interconnected world (Salomon, 2016). Part of this world is a corporate one, which has been influenced by an increase in multicultural organizations and a need for cross-cultural management (Adler, 1983; Thomas & Peterson, 2015). People with different cultural backgrounds work together in almost

every organization. Despite their cultural differences, the basic striving of most individuals is the same - to reach their full potential (Rogers, 1951). Reaching full potential is the main focus of self-actualization (Maslow, 1970).

There are different ways of achieving self-actualization, one of which is through intrinsic learning, the process that helps a person to become all that they can (Maslow, 1965). There are different ways to affect employees' growth and development, but the fastest growing means of helping people to achieve these goals is workplace coaching. Facilitating learning and the development of employees is an important factor in organizational success (Valcour, 2014). It is especially popular for executives (Hall, Otazo, & Hollenbeck, 1999).

This research paper is focused on workplace coaching, self-actualization, and a cross-cultural comparison of both coaching and self-actualization. These constructs will be described in detail in the literature review.

### A. Coaching

Coaching in one form or another has existed for a long time; however, it became a technique in the modern business world, as recently as the 1960s and 1970s (Bianichi & Steele, 2014). Over the past decade, the use of coaching in the workplace has become increasingly popular (Grant, Passmore, Cavanagh, & Parker, 2010; Joo, 2005). Due to the belief that coaching increases employees' job performance and organizational productivity in general, coaching in the workplace is becoming quite common today (Miller, 2010). Coaching involves various disciplines, and it covers many different areas (Cox, 2013). One of the major reasons for hiring coaches is to provide help with developing potential in employees (Coutu & Kauffman, 2009).

There are multiple definitions of coaching (Grant, 2012). However, most of them state that the process of coaching is about assisting individuals to organize and direct their interpersonal and intrapersonal assets towards the development of their professional and personal lives (Grant, 2012). Workplace coaching involves supporting, guiding, and inspiring the learner (Redshaw, 2000). According to the International Coach Federation (ICF) (2015), coaching is the cooperation between a coach and a client in a stimulating and creative process that encourages the client to expand their personal and professional potential.

The coaching process involves helping a client to achieve their goals through determining desired results, increasing motivation, identifying specific goals, developing action plans, and auditing progress (Linley, Harrington, & Garcea, 2010). Workplace coaches are considered to be able to make a significant contribution to the company because of the role they play, which is to produce and evaluate ideas and solutions to the present and potential problems (Bianchi & Steele, 2014).

One of the main purposes of coaching is goal-setting (David, Clutterbuck, & Megginson, 2014). According to Linley et al. (2010), the theory of goal striving is at the center of the coaching process. It is about active individual involvement in the process of goal achievement. Similar to therapists who are using the Humanistic Approach in their practice, coaches, by being facilitators, can help their clients to develop their potential by allowing them being specialists of their own cases (Stober & Grant, 2006).

There are different types of organizational coaching, including leadership, executive, career, and performance coaching. A good workplace coach has experience in all of them (Bianco-Mathis, Roman, & Nabors, 2008). However, most leading multinational companies prefer to use executive coaching (Fazel, 2013). The increased popularity of executive coaching is due to the growing focus on enhancing the productivity of executives and other leaders in organizations (Sherman & Freas, 2004).

Human growth and change are the foundations of coaching (Stober & Grant, 2006). For coaching to be able to go beyond just theoretical knowledge and be applied in practice, it needs a foundation of learning theories (Zeus & Skiffington, 2000). One of such theories is Facilitation Theory, also known as the Humanistic Approach, developed by Carl Rogers and others (Laird, 1985). The main proposition of it is that the educator will act as a facilitator during the process of learning and organize the environment for the learners in such a way that they will feel comfortable to contemplate new ideas without being intimidated by outside factors (Laird, 1985). The other theory is an adult-learning theory. Both coaching and adult learning process are focused on the person's willingness to gain new knowledge and readiness for learning (Griffiths, 2005). Instead of teaching, coaching is assisting an individual to learn on their own (Whitmore, 2002).

### *B. Self-actualization*

Abraham Maslow was the first one to introduce the concept of self-actualization (Pettit, Vaught, 1984). According to Maslow (1970), the essential motivation of an individual is "to develop and actualize his fullest potential" (p. 57). Self-actualization can be also applied as self-fulfillment and self-realization (Maclagan, 2003). Self-actualization is the ultimate need when all other, lower leveled human needs are satisfied (Maslow, 1943). However, Coan (1991) stated that the whole idea of self-actualization is very unclear, and it will remain so because the extent of actualization of an individual's innate potential cannot be verified with certainty until those potentials are effectively actualized.

There are theories that directly describe the role of self-actualization role in the workplace, such as the humanistic approach, adult-learning theories, and Theory Y. The humanistic

theory of self-actualization is a one of the common philosophical associations between humanistic therapies and coaching (Stober & Grant, 2006). Theory Y is based on the belief that, with the goal of self-actualization for employees, the organization can find a way to discover hidden resources of creativity, skills, and knowledge (McGregor, 1967). Project managers or leaders can motivate their Theory Y personality type employees through coaching strategies to be more self-motivated, responsible, and committed to their work (Brenner, 2007).

With the help of creative management, which is focused on the development of employees' self-actualization level, concept groups, organization, and with time, the whole community, can benefit (Maslow, 1965). The main reason for this is that self-actualized people are honest, responsible, and fully and selflessly concentrated on what they do, they are self-aware in making choices in order to grow and develop (Maslow, 1965). More employees prioritize work that is interesting to them and where they can satisfy their fulfillment needs to the high-paid jobs (Kovach, 1987). When employees feel that their organization cares about their development and prosperity and are attentive to their needs, then they perform the best way possible to meet the goals of the organization (Jerome, 2013).

### *C. Culture*

There are various definitions of culture (Kroeber & Kluckhohn, 1952). Hofstede (1984) states that culture is the way people look at world and their role in it, people's values and their perceptions of good and bad, true or false, and the meaning human beings have about different life aspects. According to Schein (2010), organizational culture is a pattern of shared basic assumptions that a group learned by a group while resolving its problems of external adaptation and internal integration, "which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (p. 18).

The theory of Hofstede (1983), which is based on his research, identified and explained four basic dimensions of national cultures, power distance, uncertainty avoidance, individualism versus collectivism, and masculinity versus femininity. Power distance index is a preferred type of decision making in a hierarchy between superiors and subordinates. The uncertainty avoidance index indicates the level of anxiety and avoidance of actions that can increase it in situations when there are uncertainty and ambiguity. Countries with a high Individualism index value the importance of individual being an active participant independent from the organization, who appreciates freedom and personal time. Collectivistic countries, on the other hand, are focused more on organization's goals in which individuals are dependent on it though working conditions, trainings, and provided benefits. Masculinity signifies such job aspects as earnings, recognition, and competition, while femininity points out cooperation and modesty. These four different dimensions can be used to explain different structures in organizations, different motivations that employees have within organizations, and different challenges that people deal within society (Hofstede, 1983). To be successful in multicultural organizations, managers should apply culturally specific management interventions (Hofstede, 1984).

## II. EMPIRICAL EVIDENCE

Meta-analysis and few empirical studies, have concluded that coaching is an effective tool for an organization (e.g. Luthans & Peterson, 2003; Smither, London, Flautt, Vargas, & Kucine, 2003; Meuse, Dai, & Lee, 2009). Both individual employees and organizations benefit from coaching (Elliger et al, 2003). After analyzing the data of 438 employees' surveys and 67 supervisor surveys in an industrial context, the results showed that there was a positive correlation between supervisory coaching behavior and employees' job satisfaction and performance (Elliger et al., 2003).

In general, workplace coaching improves different aspects in organizational context. The data collected by Wales (2003) demonstrated that coaching had a positive effect on developing the connection between self-development, management development, and organizational effectiveness. Leader effectiveness perceptions were found to be positively related to leader preparation and supportive coaching of self-managed teams (Morgenson, 2005). A longitudinal study conducted by Ladegard (2011) at three points in time (before coaching, after a three-month period of coaching, and a follow-up nine months later) concluded that employees who improved their work planning skills through coaching have a better chance of reducing their stress level.

A study conducted by Tooth, Nielsen, and Armstrong (2013) showed that the main benefits of being coached were in the areas of intrapersonal and interpersonal capacities, especially self-efficacy. Self-efficacy is an individual's confidence that he or she is able, through a certain behavior, to perform specific accomplishments (Bandura, 1977). The results of the evidenced-based studies show that self-efficacy is positively correlated with the career commitment (Niu, 2010), work engagement (Chaudhary, Rangnekar, & Barua, 2012), and that it has a positive impact on workers performance (Judeh, 2012).

These evidence-based findings demonstrate that workplace coaching is generally advantageous for the company and its employees: it has positive effects on employees' performance, job satisfaction, stress level, and self-efficacy (e.g. Elliger et al, 2003; Luthans & Peterson, 2003; Smither et al., 2003; Meuse et al., 2009; Wales, 2013). However, there is very little research evidence about the influence of workplace coaching on employees' self-actualization, despite the fact that it is effective for organizational prosperity (Jerome, 2013).

Margulies (1969) found in his study that there is a relationship between self-actualization and intrinsic work values, industrial work group cooperation, and satisfaction of social needs. The study by Carland, Carland, and Carland (1995) showed that people with higher entrepreneurial drive viewed their businesses as the ways to achieve self-esteem and self-actualization rather than just as providers of their basic financial needs. Hofstede's study (1984) showed that there is a difference in the need for self-actualization depending on the type of culture, individualistic versus collectivistic. Self-actualization is a supreme need in an individualistic society, while in a collectivistic society the sense of belongingness comes before self-actualization and esteem (Hofstede, 1984).

Depending on the culture, coaching experience and level of self-actualization vary in organizations from different countries. One of the largest studies done to investigate the relationships

between culture and societal, organizational, and leader effectiveness was GLOBE (GLOBE, 2014). Even though GLOBE project was mostly focused on leadership effectiveness and culture, its findings also determined how similar and dissimilar to each other depending on their values (GLOBE, 2014).

There are three main gaps in the research provided about coaching and self-actualization. First, the influence of coaching on self-actualization has been presented so far only as a theory. There is no hard data supporting any of the theories provided. Second, most of the published literature is about coaching at the executive level, and not at the other lower level positions in the workplace. The primary form of coaching in current research is executive coaching (Grant, 2003). The third gap is connected with the cross-cultural comparison. There is some data to describe cultural differences, but very limited evidence about coaching and self-actualization in a cross-cultural comparison. Due to the gap in the literature, the main goal of this study is to collect information that will expand the existing knowledge about the relationships between workplace coaching and employees' self-actualization, and their cross-cultural comparison. The first hypothesis is that workplace coaching increases employees' level of self-actualization. The second hypothesis is that there is a significant difference between coaching and self-actualization across countries.

## III. METHOD

### A. Participants

Participation in the study was voluntary and anonymous. The method of sampling used in the study was convenience sampling. There were 135 participants, the majority of whom were females (69.6%) with only 30.4% males. The age of the participants ranged from 22 to 76 years old, with a mean age of 33 years old. The racial and ethnical identity of the participants was predominantly White (66.7%). 19.3% were Hispanic/ Latino, and the rest 14.0% represented Asians (3.0%), Black/ African Americans (2.2%), multiracial individuals (2.2%), and participants of other races (6.6%). Participants' countries of residence were divided into three categories: European Union, North America, and post-USSR countries. European Union category included 25.9% of the participants from countries such as Poland, Germany, Denmark, Spain, United Kingdom, Slovenia, Sweden, and Italy. North America category included 43.7% of the participants from such countries as the United States and Canada. Post-USSR countries included 30.4% of the participants from countries such as Russia, Ukraine, and Belarus. In the current job category, majority of the participants were professionals (40.0%). 15.6% had managerial positions, 13.3% were at the entry level ones, and 11.9% were self-employed. There were only 5.9% of executives, and 3.0% of unemployed. 11.4% represented other categories not included on the list.

### B. Instrumentation

The survey was designed to measure the relationships between workplace coaching and participants' self-actualization. It was presented into two languages: English and Russian. The survey was translated into Russian by the researcher, who is a native

speaker and reviewed by two other native Russian speakers who confirmed the comprehension and adequacy of the content. The survey contained three parts. The first part consisted of demographic questions, which included gender, ethnicity, age, current job, level of education, annual income, country of birth, and current residency.

The second part of the survey involved questions regarding coaching. There was a set of 7 required-to-answer questions, which included a 5-point Likert scale that ranged from 1= strongly disagree to 5= strongly agree. If the participant was coached, then he or she answered a set of 7 questions, the first 6 of which were taken from the Coachees Evaluation of the Impact of Participating in Developmental Coaching (questions 1,2,3,5,6, and 7) (Leonard-Cross, 2010). Question 7 evaluated the relationship between coaching and self-actualization. If the participant was not coached, then he or she answered a set of the similar to the above mentioned 7 questions based upon their perceptions (I think) rather than their beliefs. In the Russian version, there was a definition of coaching provided before asking the 7 questions due to the lack of general understanding of this term and limited use of it.

The third part of the survey was designed to measure self-actualization. Nine items were developed based upon the original work of Bonjean and Vance (1968)'s Short-Form Measure of Self-Actualization. The items were edited to reflect preference as oppose to actual state. That part of survey included a 5-point Likert scale that ranged from 1= strongly disagree to 5= strongly agree. The estimated time to take a survey was 10 minutes.

### C. Procedure

An Informed Consent Form was provided at the beginning of the survey in both languages: English and Russian, notifying individuals that their participation was voluntary and anonymous, and there were no known risks for participating in the survey. The Informed Consent Form also included information about the general nature of the study, the right to withdraw from the study at any time, data storage, and contact information in case of future questions or interest in knowing the results. In order to start the survey, individuals had to agree with the condition described in the Informed Consent Form.

The data was collected via the Internet using the survey software program QuestionPro from March through August 2016. The survey hyperlink was administered to the participants in one of the three ways: email, text message, or via social media, such as Facebook (in English) and V Kontakte (in Russian).

## IV. RESULTS

There were two main hypotheses for the study. The first one stated that workplace coaching has a positive effect on employees' self-actualization level. It was based on the humanistic theory of self-actualization (Maslow, 1970) and the belief that human growth is a fundamental principal of coaching (Stober & Grant, 2006). The second one stated that there are significant differences between coaching and self-actualization across countries. It was based on the empirical evidence of the cultural dimensions in management in different countries (Hofstede, 1984).

### A. Correlations

The correlation test was run to find out if there is a correlation between self-actualization index and coaching index. There were two correlations: the first one for the index of the participants who have been coached and self-actualization index, and the second one for the index of the participants who have not been coached and self-actualization index. The correlation test results (see Table 1) showed that in both cases correlations were not statistically significant. The correlation between coaching index of those who have been coached at the workplace and self-actualization index was  $r = .188$ , and  $p = .140$ . The correlation between coaching index of those who have not been coached at the workplace and self-actualization index was  $r = .187$ , and  $p = .116$ .

### B. ANOVA Analysis

The ANOVA test was used to identify if there was a statistically significant difference in the test scores of self-actualization index among the three groups of participants based on their place of residence: European Union, North America, or post-USSR country. The ANOVA test results (see Table 2) showed that there is no statistically significant difference in the average scores of self-actualization index between those from European Union ( $\mu = 31.543$ ) and those from North America ( $\mu = 30.932$ ) ( $p = .543$ ,  $\alpha = .05$ ), and between those from post-USSR countries ( $\mu = 30.024$ ) and those from North America ( $\mu = 30.932$ ) ( $p = .175$ ,  $\alpha = .05$ ). But the mean self-actualization score for those from European Union was statistically significantly lower than the score for those from post-USSR countries ( $p = .019$ ).

### C. Chi-square test

The Chi-square test was run to determine if there was a statistically significant difference in workplace coaching experiences in terms of the place of residence (European Union, North America, or post-USSR country). The Chi-square test results (see Table 4) showed a Sig. (p) value of .021, indicating that there is a statistically significant difference among workplace coaching experiences (being coached vs. not being coached at the workplace) when it comes to the place of residence.

## V. DISCUSSION

The purpose of the study was to verify two hypotheses. The first hypothesis was about the positive correlation between the workplace coaching and employees' level of self-actualization. The results showed that there was no statistically significant correlation between these two variables. There are multiple reasons that could explain these findings. The first challenge with HR coaching is that there is a lack of trust between the coaches and those whom the coaching is intended for (Spence, Armour, Driessen, Lea, & North, 2016). The lack of benevolence, competence, and integrity could be a possible explanation of coaching failure to succeed in many organizations (Spence et al.,

2016). This provides evidence for the need of official regulations to become a coach.

The second issue is that there is no best mechanism to evaluate coaching (Grant, 2012), and there is a lack in evaluation of coaching programs by organizations (Leonard-Cross, 2010). It is difficult to measure the effectiveness of coaching because of its nature and differences in factors for each coachee, such as goals, background, and other circumstantial factors (Grover & Furnham, 2016).

The third issue is that most of the research done thus far about coaching and its effectiveness is based on the executive level positions (Grant, 2003). Only 5.9% of the participants in this study represented executives. This shows that there is a possible need for improving the practice of coaching among all the positions across organization, not only executive ones, and that there is a need for more empirical evidence in coaching practices around the whole organization.

The second hypothesis was that there is a significant difference between coaching and self-actualization across countries. The ANOVA test results showed that there is a statistically significant difference between the level of self-actualization of the participants from European Union and post-USSR countries, which is important for the organizational management to take into consideration and be culturally specific in their practices. There was no significant difference between the level of self-actualization of the participants from European Union and North America, or from post-USSR countries and North America. This result can be explained by the higher level of variability among the participants from North America because there is more diversity in culture (Campbell & Kean, 2016).

The Chi-square test results showed a statistically significant difference in the workplace coaching experience (being coached vs. not being coached at the workplace) and the participants' place of residence, including European Union, North America, and post-USSR countries. These findings can be explained by the cultural differences across countries, and coaching popularity in North America and Europe, and lack of its exposure in post-USSR countries. It is a relatively new phenomenon there.

After the collapse of the Soviet Union, many of those countries that were part of it began moving in the direction of the Western management system. But this process is very slow because of the Communist-based centrally planned economy that existed there for decades and the diversity among central and eastern European countries. When it comes to management, people are still debating whether they want to continue being under the social benefits of Communist regime, or they want to get rid of extensive political power on top of them and start planning new economy policy (Perlitz & Seger, 2004). In order to be more efficient in their economy markets, post-Soviet Union countries need to evolve business environment that exist in Europe and Western countries, their business strategies and management style (McCarthy, Vikhanski, Puffer, & Naumov, 2005). Since they are only at the beginning stage of this transition, and because of the lack of experience in Western-style management system, workplace coaching is not very popular phenomenon there yet. However, little by little it is moving in this direction.

## VI. LIMITATIONS

There are a few limitations to this study. Due to the use of the convenient sampling, the data cannot be generalized to a larger population. Discrepancies in cell sizes representing unequal number of participants, and different interpretations of the definition of coaching based on the participants' personal assessments and experience could have affected the results.

## VII. CONCLUSION

In conclusion, culture and cultural background of employees directly influence success of an organization. European Union, North America and post-USSR countries consist of many very distinct management cultures that differ by particular country. Leaders and management team members should take it into consideration when planning their strategies. Self-actualization level and need for it also varies depending on the culture. In some places, coaching can be a good source to help develop it, while in others there maybe alternatives, which are more efficient.

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Table 1

**Correlations**

		Coaching Index Of Coached Participants	Self- Actualization Index
Coaching Index Of Coached Participants	Pearson Correlation	1	.188
	Sig. (2-tailed)		.140
	N	63	63
Self-Actualization Index	Pearson Correlation	.188	1
	Sig. (2-tailed)	.140	
	N	63	63

**Correlations**

		Coaching Index Of Uncoached Participants	Self- Actualization Index
Coaching Index Of Uncoached Participants	Pearson Correlation	1	.187
	Sig. (2-tailed)		.116
	N	72	72
Self-Actualization Index	Pearson Correlation	.187	1
	Sig. (2-tailed)	.116	
	N	72	72

Table 2

**Descriptives**

Self-Actualization Index

	N	Mean	Std. Deviation
European Union	35	31.543	1.9303
North America	59	30.932	2.6708
Post-USSR countries	41	30.024	2.2526
Total	135	30.815	2.4256

**ANOVA**

Self-Actualization Index

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	44.980	2	22.490	3.993	.021
Within Groups	743.390	132	5.632		
Total	788.370	134			

**Multiple Comparisons**

**Table 3** Dependent Variable: Self-Actualization Index  
Sidak

(I) Country of Residence	(J) Country of Residence	Mean Difference (I-J)	Std. Error	Sig.
European Union	North America	.6107	.5063	.543
	Post-USSR countries	1.5185*	.5461	.019
North America	European Union	-.6107	.5063	.543
	Post-USSR countries	.9078	.4825	.175
Post-USSR countries	European Union	-1.5185*	.5461	.019
	North America	-.9078	.4825	.175

\*. The mean difference is significant at the 0.05 level.

**Have you ever been coached\* Country of Residence Crosstabulation**

			Country of Residence			Total
			European Union	North America	Post-USSR countries	
Have you ever been coached	1.0	Count	15	35	13	63
		% of Total	11.1%	25.9%	9.6%	46.7%
	2.0	Count	20	24	28	72
		% of Total	14.8%	17.8%	20.7%	53.3%
Total		Count	35	59	41	135
		% of Total	25.9%	43.7%	30.4%	100.0%

**Chi-Square Tests**

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.687 <sup>a</sup>	2	.021
Likelihood Ratio	7.796	2	.020
Linear-by-Linear Association	1.213	1	.271
N of Valid Cases	135		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 16.33.

# Effects of heat-killed *Lactobacillus plantarum* strain L-137 on larvae quality and growth performance of white leg shrimp (*Litopenaeus vannamei*) juveniles

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**Abstract-** This study was conducted to determine the effects of supplemental LP20 on growth performance and immune response of postlarvae (PL) and juvenile stages of white leg shrimp, *Litopenaeus vannamei*. The LP20 contains 20% heat-killed *Lactobacillus plantarum* strain L-137 (HK L-137) and 80% dextrin in dried-weight basis. The study was conducted for two phases: Phase 1 (hatchery stage- PL<sub>1</sub> to PL<sub>15</sub>) was carried out indoor with four treatments by supplementation of LP20 at 0.0 g (marked as LP20-0.0), 0.5 g (LP20-0.5) and 1.0 g (LP20-1.0) LP20 kg<sup>-1</sup> of feed to the basal diet. The basal diet without LP20 was set up as a control that used in the whole experimental period (including Phase 1 and Phase 2). Initial PLs of *L. vannamei* were cultured at stocking density of 75,000 nauplii 0.5 m<sup>3</sup> tank<sup>-1</sup>. The results showed that the final weight and length of PLs (at PL<sub>15</sub>) fed feed containing 1.0 g of LP20 kg<sup>-1</sup> of feed were significantly higher than those of PLs fed basal diet ( $P < 0.05$ ). Total bacteria count in PL<sub>15</sub> was significantly different between LP20 supplemented groups (LP20-0.5 and LP20-1.0) and without LP20 supplemented groups (LP20-0.0 and control). Phase 2 (nursery stage- PL<sub>16</sub> to PL<sub>45</sub>) was conducted continuously from Phase 1, in which, similar-sized shrimps of each treatment, including LP20-0.0, LP20-0.5 and LP20-1.0 were selected and divided into two groups, fed with a reduction of bacterial doses (at 0.1 g and 0.25 g kg<sup>-1</sup> of feed). The results showed that the highest specific growth rate (SGR) was found in the treatment LP20-1.0 that fed diet supplemented LP20 at 0.25 g kg<sup>-1</sup> of feed (1.0LP20-0.25) and significantly differed compared with the control ( $P < 0.05$ ); however, there was no significant difference in SGR among the LP20 supplemented diets. The highest bacterial densities were observed in the hepatopancreas of shrimp of the 0.5LP20-0.1 treatment (in comparison with other treatments,  $P < 0.05$ ). Similarly, the lowest *Vibrio* spp. density ( $10 \times 10^3$  colony-forming units (cfu) sample<sup>-1</sup>) was counted in the hepatopancreas of shrimp of the 0.5LP20-0.1 treatment. Bacterial challenge test showed that the significantly lowest cumulative mortality (7.5%) was found in the 0.5LP20-0.1 treatment when compared with other treatments ( $P < 0.05$ ). Thus, the findings of this study indicated that the supplementation of 0.5 g of LP20 kg<sup>-1</sup> of feed to the diet used for white leg shrimp at PL stage and continuing feeding PL with 0.1 g of LP20 kg<sup>-1</sup> of feed enhanced growth performance and improved immune system.

**Keywords:** Heat-killed bacteria, *Lactobacillus plantarum*, *Litopenaeus vannamei*, postlarvae, juvenile, growth performance, quality

## I. INTRODUCTION

The requirement of white leg shrimp, *Litopenaeus vannamei*, production has been increased rapidly in the world. In which Asia countries accounted for 61% in 2011 and 85% in 2013 of global shrimp exports (FAO, 2015). It has contributed to the increase of white leg shrimp production as well as intensification culture system in many countries in Asia, including Viet Nam. However, it may due to high risk of diseases outbreak. Obviously, vibriosis is one of the major diseases occurred in cultured shrimp causing high mortality rate during practice period. Vibriosis has been reported related to a number of *Vibrio* species, including *V. harveyi*, *V. vulnificus*, *V. parahaemolyticus*, *V. alginolyticus* and *V. penaeicida*. Among these bacterial species, *V. harveyi* and *V. alginolyticus* are known as endemic opportunistic pathogens in cultured white leg shrimp. One of the serious diseases, namely early mortality syndrome or acute hepatopancreatic necrosis syndrome, has happened in cultured white shrimp in Southeast Asia since 2010; this resulted in thousands of farmer facing to lose their income every year.

Application of antibiotics in aquaculture is commonly to reduce the infection which might lead to overuse of antibiotic. Therefore, either reducing diseases outbreak (and/or mitigation of infections) or improving immunity system of cultured animals by antibiotic substitution should be considered in detail. In order to overcome these problems, many studies in stimulating and improving the immune system of shrimp, e.g. However, the development of genetically based host resistance is costly and impossible to attain the specific pathogen resistance populations. The use of antibiotic causes resistance in microbes for human health and environment pollution by its residues as well (Martines, 2009). Therefore, high qualities of shrimp larvae that are able to improve growth performance, immunity and prevention of pathogens are of primary concerns.

LP20 is a heat-killed *Lactobacillus plantarum* feed mixes containing 20% HK L-137, a new product manufactured by House Wellness Foods Corporation Japan, is considered to be a good nutrition additive to cultured white leg shrimp. We assume

that using LP20 may improve growth and quality of larvae white leg shrimp at postlarvae (PL) stage. Therefore, House Wellness Foods Corporation Japan has strongly supported for this current research.

Studies have shown that using LP20 boosts the immune system and enhances the health, resulting in improving growth performance of aquaculture. Previous study showed that addition of 0.1 or 1.0 g of LP20 kg<sup>-1</sup> of feed have induced a good growth and survival rate of juvenile Kuruma shrimp (Tung *et al.*, 2009). In addition, Duc *et al.* (2016) also found that supplementation of 0.1 g of LP20 kg<sup>-1</sup> of feed enhanced good growth of white leg shrimp at the grow-out stage. However, there is no previous study on the effects of LP20 on growth performance of white leg shrimp at larvae and juvenile stages; thus, this present study was conducted.

## II. MATERIALS AND METHODS

### A. Experimental shrimp nauplii

Shrimp nauplii were obtained from a commercial hatchery (certification of SIS Hawaii, USA). Before commencement of the experiment, nauplii were slowly acclimated to the experimental conditions in the Wet-Lab, College of Aquaculture and Fisheries, Can Tho University, Viet Nam.

### B. LP20 source and experimental design

LP20 (Itami, Japan) contains 20% heat-killed *L. plantarum* strain L-137 (HK L-137) and 80% dextrin in dried-weight basis. The concentration of LP20 in the dry completed product is  $2 \times 10^{11}$  colony-forming units (cfu) g<sup>-1</sup>. The LP20 was prepared based on the previous method, described by Murosaki *et al.* (1998). The two doses of 0.5 g and 1.0 g of LP20 kg<sup>-1</sup> of feed were supplemented to diets of white leg shrimp larvae and juveniles. Schematic design of these experiments is shown in Table 1.

Phase 1 (hatchery stage- PL<sub>1</sub> to PL<sub>15</sub>) was carried out indoor with four treatments. The first diet contained 0.0 g of LP20 kg<sup>-1</sup> of feed (marked as LP20-0.0), this treatment used as control and provided animal for the next phase (Phase 2). The second and the third treatments, LP20 was added to the diets at 0.5 g (LP20-0.5) and 1.0 g of LP20 kg<sup>-1</sup> of feed (LP20-1.0), respectively. The fourth one is a control, which was fed diet without supplemented LP20, which used for the whole experimental period (including Phase 1 and Phase 2). Nauplii of shrimp were cultured in 0.5m<sup>3</sup> tank at a stocking density of 75,000 nauplii tank<sup>-1</sup>, for all treatments.

In the Phase 2 (nursery stage- PL<sub>16</sub> to PL<sub>45</sub>), after finishing the Phase 1, the similar size of shrimps from each treatment 1, 2 and 3 were introduced into two groups, with three replicates for each, at 1.0 g (Duc *et al.*, 2016) and 0.25 g of LP20 kg<sup>-1</sup> of feed, respectively. The treatment 0.0LP20-0.1 and 0.0LP20-0.25 indicated shrimp from LP20-0.0 treatment (Phase 1) were fed with diet containing 0.1 g and 0.25 g of LP20 kg<sup>-1</sup> of feed, respectively. Treatment 0.5LP20-0.1 and 0.5LP20-0.25 indicated shrimp from LP20-0.5 treatment (Phase 1) were fed diet containing 0.1 g and 0.25 g of LP20 kg<sup>-1</sup> of feed, respectively, and the similar marks set up for treatments 1.0LP20-0.1 and 1.0LP20-0.25.

At the end of Phase 1, the same sizes of PL (at PL<sub>15</sub>) (10.1±0.24 mm in length and 0.0062±0.001 g in weight) were selected and used for Phase 2. The stocking density was 1,000 PL 0.5 m<sup>3</sup> tank<sup>-1</sup> (Tao *et al.*, 2015); salinity was 15‰ with applying Biofloc technique. Bioflocs were created by using rice powder (73.4% carbohydrate and 0.26 % protein), at a C:N ratio of 15:1. Amount of rice powder was added into the tanks for every three day based on the amount of feed fed and protein level of the feed (Avnimelech, 1999). The experiment was randomly designed among treatments under shade condition (30% cover, using nylon netting).

### Formalin stress test

The quality of PL<sub>15</sub> at the end of Phase 1 was tested using formalin: at least ten PL<sub>15</sub> were randomly selected from each of treatments and bathed with formalin at 150 ppm for one hour. Three replicates were done for each of treatments. The mortality of shrimp was recorded.

### C. Visual criteria (size and colour of PL<sub>15</sub>)

Quality of PLs was evaluated daily based on visual observation criteria, described by FAO (2007).

### D. Bacterial count

Three shrimps per tank were sampled at the stage of PL<sub>15</sub> and PL<sub>45</sub> for bacterial count using a standard plate count method. The whole shrimp of PL<sub>15</sub> and the intestine (IN) and hepatopancreas (HP) of PL<sub>45</sub> were dissected aseptically. The whole shrimp, IN and HP were weighed and homogenized in 1.0 mL of sterile saline solution (SSS) (0.85% NaCl). Serial 10-fold dilutions of the supernatant were performed; 0.1 mL of the solution was cultured on TCBS Agar (Himedia, India) and Nutrient Agar (Himedia, India) (1.5% NaCl) to enumerate the *Vibrio* spp. and total bacteria count, respectively. The treatments were carried out in three replicates. The plates were incubated at 30°C for 24 hours. The results are reported as cfu per larvae (for PL<sub>15</sub>) and cfu per sample (for PL<sub>45</sub>).

### E. Bacterial challenge experiment

At the end of Phase 2, 15 shrimps from each replicate of each treatment were challenged by immersion with *Vibrio parahaemolyticus* at  $1.1 \times 10^8$  cfu mL<sup>-1</sup> (LD50). The challenge experiment was conducted as described by Tran *et al.* (2013) with modifications. Shrimps in the control group were used as negative treatment, immersed in sterilized Nutrient Broth plus 1.5% NaCl. Three replicates were performed for the challenge and negative treatments. The experiment was conducted for 14 days. Moribund shrimp were recorded every day and were collected for DNA extraction and PCR amplification as previously described (Sritunyalucksana *et al.*, 2014).

### Feed used for larvae and juveniles

At the larvae stage (Phase 1), larvae were fed commercial feed, including of Lansy and Frippak (Inve. Company, Belgium).

At the nursery stage (Phase 2), shrimps were fed commercial feed (Grobest Company, Viet Nam). Feeding behavior of shrimp was observed and the feed amount was adjusted by stages of shrimp according to the instruction of the manufacture and actual feeding level of shrimps (feeding regime was based on the sizes of PL, PL<sub>15</sub> were fed with powder (42% protein) at 15% body

weight (BW). The amount of feed (crumble feed and pellet) was then reduced to 5-6% BW when the shrimp was weighed individually about 0.1-0.5 g up the end of the experiment. LP20 was mixed in water before adding to the feed; the feed was then coated by squid oil (1.5 mL 100 g<sup>-1</sup> of feed). Animals were fed four times a day at 7:00, 11:00, 16:00 and 20:00.

#### F. Growth performance

The growth performance in weight (g) and length (mm) of PLs and juveniles were measured at the stages of PL<sub>5</sub>, PL<sub>10</sub>, PL<sub>15</sub>, PL<sub>30</sub> and PL<sub>45</sub> at 5, 10, 15, 30 and 45 days post culture, respectively. At least 100 shrimps tank<sup>-1</sup> were weighed, three replicates for each treatment.

$$\text{Specific growth rate (SGR, \%)} = \{(\ln W_f - \ln W_i) / T\} \times 100$$

$$\text{Daily weight gain (DWG)} = (W_f - W_i) / T$$

$$\text{Survival (\%)} = (\text{final No. of shrimp} / \text{initial No. of shrimp}) \times 100$$

Where, W<sub>f</sub> is final weight, W<sub>i</sub> is initial weight and T is total day of the experiment

#### G. Water quality measurement

Temperature was measured using thermometer. pH value was measured every 3 days (at the morning and afternoon) using pH meter (HANA brand, USA). N-NO<sub>2</sub> and TAN (NH<sub>3</sub>/NH<sub>4</sub>) were checked every week using Test Sera (Germany).

#### H. Data analysis

The data were subjected to One-way ANOVA, followed by Duncan test to compare the weight gain (g), SGR (% body weight/day) and feed conversion ratio (FCR) (dry feed eaten/weight gain) among the treatments.

### III. RESULTS AND DISCUSSION

#### Water parameters

Table 2 and 3 showed the measurements of water parameters of all treatments. The results showed that water temperatures in the first phase were slightly higher, but stable and less fluctuated within the day compared with the second phase.

Water temperature in all treatments of Phase 2 ranged from 26-28°C and slightly fluctuated between the morning and afternoon. The same trend for pH level, ranging from 7.9 to 8.2 within a day, was recorded.

#### Growth performance of shrimps

Phase 1 (PL stage- PL<sub>1</sub> to PL<sub>15</sub>): Table 4 showed the growth performance of PL after 15 days. The results showed that both final weight and length of PL fed feed containing LP20 were significantly higher than those of PL fed feed without addition of LP20 ( $P < 0.05$ ); and the weight and length of PLs fed feed containing 1.0 g of LP20 kg<sup>-1</sup> of feed was highest. Similarly, survival rates of PLs that fed feed containing LP20 were significantly higher than those of animals fed feed without LP20 ( $P < 0.05$ ). There was no significant difference in both shape and color of PLs in all treatments.

Formalin challenge test resulted in none of died PL<sub>15</sub> was observed during the test, suggesting there was no significant difference in mortality of PL<sub>15</sub> in all treatments.

Total bacteria count in PL<sub>15</sub> was significantly different between the groups supplemented with LP20 (LP20-0.5 and LP20-1.0) and without LP20 (LP20-0.0 and controls). The highest density of total bacteria was observed in the LP20-1.0 treatment, showing significantly at  $P < 0.05$  (Figure 1). Total amount of *Vibrio* spp. in PL<sub>15</sub> was lower in the treatments fed LP20. The lowest *Vibrio* spp. density was recorded in the treatment LP20-0.5 at the value of  $0.74 \times 10^5$  cfu larvae<sup>-1</sup> in comparison to other treatments ( $P < 0.05$ ). It has been reported that total bacteria count was determined lower in the probiotic supplemented shrimp group than in the control shrimp group (Sivakumar *et al.*, 2012). In this study, total bacteria count was increased, whereas the lower density of *Vibrio* count observed in the LP20 supplemented groups. It is possible that LP20 might increase intestinal probiotic bacteria and they inhibit the growth of pathogenic bacteria, *Vibrio* sp. The competition for similar nutrients and secretion of antimicrobial agents are among reported capacities of probiotics (e.g. *Bacillus* sp., *Lactobacillus* sp.) to control pathogenic bacteria in shrimp intestines (Moriarty 1998; Verschuere *et al.*, 2000; Balcazar *et al.*, 2006).

Phase 2 (rearing stage PL<sub>16</sub> to PL<sub>45</sub>): The growth performance of PLs in Phase 2 was shown in Table 5 and Table 6. The results revealed that no significant difference in the length of PLs among the treatments for the first 15 days after PL<sub>15</sub> stage was observed ( $P > 0.05$ ); however, the body length of PLs fed feed supplemented with LP20 was significantly increased compared with such of PLs fed feed without LP20 after 45 days. The highest SGR ( $4.89 \pm 0.44\%$  day<sup>-1</sup>) of PLs was found for those in the treatment 0.5LP20-0.1 and significantly higher than that of PLs in the treatment 0.5LP20-0.25 and controls.

The highest SGR was found in PLs of the treatment 1.0LP20-0.25 that fed feed supplemented with 0.25 g of LP20 kg<sup>-1</sup> of feed. There was a significant difference in SGR of PLs fed diet supplemented LP20 compared with the controls fed diet without LP20 ( $P < 0.05$ ); however, there was no significant difference in SGR among the PLs fed diets added LP20 ( $P > 0.05$ ).

After 30 days of rearing from PL<sub>15</sub> to PL<sub>45</sub>, the results showed that the highest survival rate was found in the PLs of the treatment 1.0LP20-0.1 and 1.0LP20-0.5; however, there was no significant difference among the PLs of treatments fed with different diets.

The highest FCR was found in the control treatment that differed significantly from the treatment fed with diet supplemented 0.25 g of LP20 kg<sup>-1</sup> of feed ( $P < 0.05$ ), but not significantly differed from such fed with diet supplemented 0.1 g of LP20 kg<sup>-1</sup> of feed ( $P > 0.05$ ). Both shape and color of juveniles were similar in all treatments after 45 days.

#### Quality of juveniles (PL<sub>45</sub>) parameters

In the stage of PL<sub>45</sub>, the highest amount of bacteria were determined in the HP of shrimp in the treatment 0.5LP20-0.1 ( $P < 0.05$ ). The lowest *Vibrio* spp. density was also observed in the HP of shrimp in the treatment 0.5LP20-0.1, with an amount of  $1.0 \times 10^4$  cfu sample<sup>-1</sup> (Figure 2).

The density of *Vibrio* spp. in the IN samples was found to be at the lowest in shrimp of the treatment 0.5LP20-0.1 (accounted for

$1.4 \times 10^6$  cfu sample<sup>-1</sup>) in comparison to the control (accounted for  $3.9 \times 10^6$  cfu sample<sup>-1</sup>) ( $P < 0.05$ ) (Figure 3).

The effects of probiotic on microbiota was also examined in black tiger shrimp (*Penaeus monodon*). Shrimp were fed live-sprayed *Bacillus* (LS) or freeze-dried *Bacillus* (FD) for 120 days. The result showed that shrimp supplemented with LS and FD contained significantly lower number of *Vibrio* count ( $P < 0.05$ ) in the hepatopancreas, intestine compared to those in the control group (Boonthai *et al.*, 2011). Similarly, Li *et al.* (2007) reported that the number of *Vibrio* count in the digestive tract of *L. vannamei* treated with probiotic (*Bacillus licheniformis*) were significantly decreased compared to those in the control shrimp. Probiotics could prohibit the growth of pathogens by production of antimicrobial substance such as organic acids, hydrogen peroxide and bacteriocins (Reid *et al.* 2001). In case of *L. plantarum*, the bacteria has been reported to produce bacteriocin, plantaricin A (Nissen-Meyer *et al.* 1993).

LP20 contains HK L-137, heat-treated bacteria, and it might inhibit the growth of pathogens by increasing intestinal probiotic bacteria or by inducing antimicrobial substance to intestine indirectly.

#### Bacterial challenge experiment

The survival rate of the *V. parahaemolyticus* infected PLs in the treatments that supplemented with LP20 were significantly higher than those in the control ( $P < 0.05$ ). The highest cumulative mortality (62%) of the shrimps was recorded in the control treatment. The cumulative mortality in the treatments supplemented with LP20 exhibited in a range of 7.5% (in the treatment 0.5LP20-0.1) to 41.3% (1.0LP20-0.25). However, non-died shrimp was recorded in the negative treatment (Figure 4).

Similarly, several studies have been demonstrated with different *Lactobacillus* spp. harboring strong antimicrobial activity against pathogenic bacteria. Specifically, *P. monodon* were fed with supplemented *Lactobacillus acidophilus* food ( $10^5$  CFU/g) for 1 month before challenging to *Vibrio alginolyticus*. The challenge resulted in 20% accumulative mortality in the probiotic supplemented group as compared to 86.7% in the control group (Sivakumar *et al.*, 2012). Vaseeharan and Ramasamy (2003) documented that luminescent-pathogenic *Vibrio harveyi* could be inhibited by a probiotic bacteria *Bacillus subtilis* BT23 under in vitro and in vivo conditions. In this experiment, the result had demonstrated that the use of *L. plantarum* can reduce the shrimp mortality rate after challenging to *V. parahaemolyticus*.

Recently, we have shown that LP20 plays an important role in immune modulation of white leg shrimp by increasing THC, phenoloxidase activity, phagocytic activity, clearance efficiency and survival rates (Pham Minh Duc *et al.*, 2016). It is possible that LP20 augments immune function and decreases the mortality of the *V. parahaemolyticus* infected PLs.

Moribund shrimp were then randomly selected for testing the presence of *V. parahaemolyticus* in challenged shrimps using two step-PCR method. The results showed that the bacterium *V. parahaemolyticus* was detected in the challenged shrimps, showing a bright band at 230 base pair through agarose gel electrophoresis (Figure 5).

## IV. CONCLUSION

Nauplii fed diet supplemented with 1.0 g of LP20 kg<sup>-1</sup> of feed displayed an effective growth performance.

In the nursery stage (from PL<sub>16</sub> to PL<sub>45</sub>) that the PLs from LP20-1.0 treatment fed diet added with 0.25 g of LP20 kg<sup>-1</sup> of feed showed a better growth performance; no significant difference in the SGR of PLs selected from LP20-0.5 fed with diet containing 0.1 g of LP20 kg<sup>-1</sup> of feed.

The shrimps fed with diets supplemented with 0.5 g of LP20 kg<sup>-1</sup> of feed at first and fed with such supplemented with 0.1 g of LP20 kg<sup>-1</sup> of feed at later were enhanced growth performance and improved immune system.

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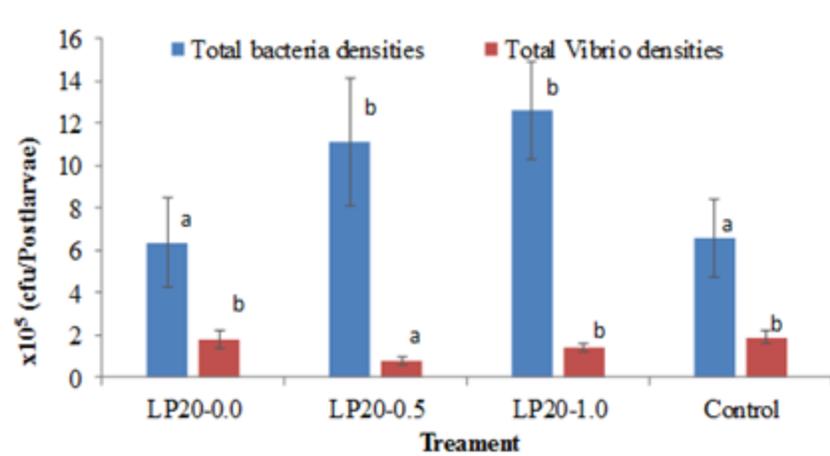


Fig. 1. Bacteria densities isolated from the shrimps at PL<sub>15</sub> stage

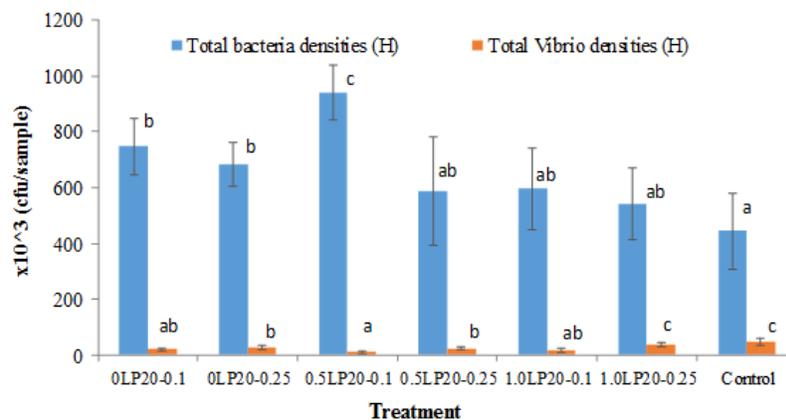


Fig. 2. Bacteria densities isolated from hepatopancreas of the shrimps at PL<sub>45</sub> stage

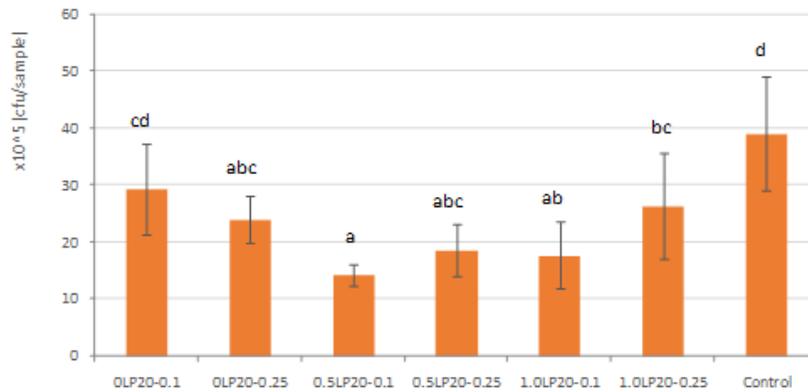


Fig. 3. *Vibrio* spp. densities isolated from intestine of the shrimps at PL<sub>45</sub> stage

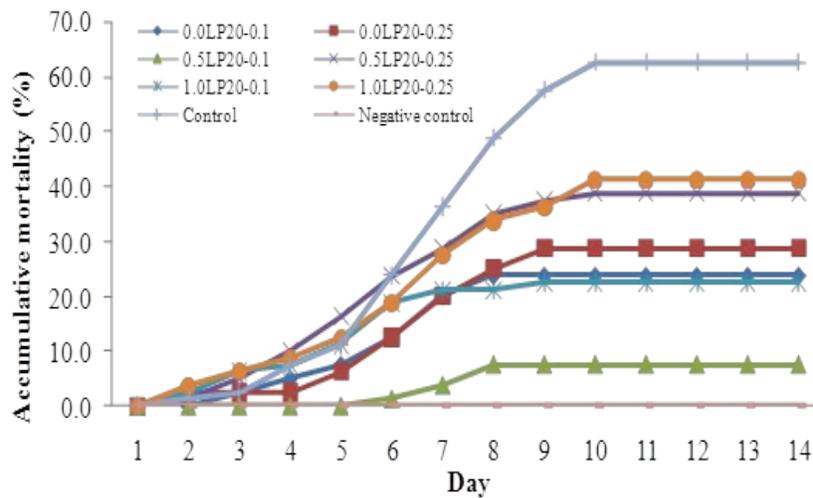


Fig. 4. Cumulative mortality in shrimps inoculated with *Vibrio parahaemolyticus* at  $1.1 \times 10^8$  cfu mL<sup>-1</sup> (LD50)

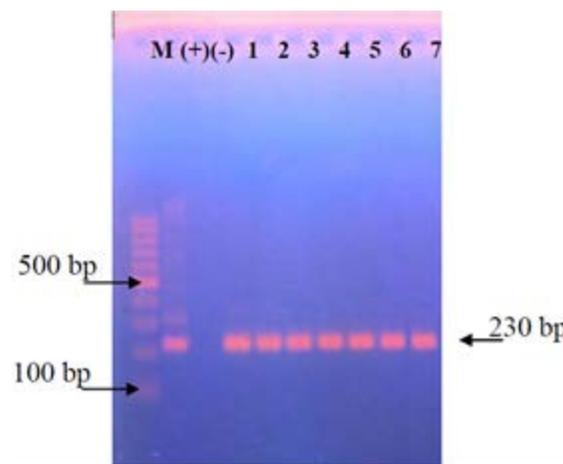


Fig. 5. PCR amplification results of detecting *Vibrio parahaemolyticus* from infected shrimp. Lane M indicates 100bp ladder; Lane (+) indicates positive control; Lane (-) indicates negative control; Lane 1,2,3,4,5,6,7 indicates the shrimp DNA isolated from treatment 0.0LP20-0.1, 0.0LP20-0.25, 0.5LP20-0.1, 0.5LP20-0.25, 1.0LP20-0.1, 1.0LP20-0.25, respectively.

**Table 1: Schematic design for the application of LP20 on postlarvae and nursery stages of *L. vannamei***

Treatment	Hatchery				Nursery	Bacterial challenge test
	Nauplius	Zoea	Mysis	Post larvae (PL <sub>1-15</sub> )	PL <sub>16-45</sub>	
	No application of LP20			Application of LP20 (g/kg)		
				Phase 1	Phase 2	Selected 2 good result from phase 2
1	No LP20			0.00	0.10	
					0.25	
2				0.50	0.10	
					0.25	
3				1.00	0.10	
					0.25	
4	0.00					

**Table 2: Measurements of water parameter in all treatments of Phase 1**

Parameter		Treatment		
		0.0LP20	0.25LP20	1.0LP20
Temp. (°C)	AM	28.8±1.9	28.5±1.6	28.3±1.3
	PM	29.3±1.5	29.0±1.3	28.8±1.1
pH	AM	8.18±0.19	8.20±0.19	8.17±0.21
	PM	8.18±0.20	8.18±0.20	8.18±0.19
Alkalinity (mg/L)		116.4±10.3	117.8±12.2	117.8±12.0
TAN (mg/L)		0.2±0.2	0.5±0.6	0.3±0.3
N-NO <sub>2</sub> <sup>-</sup> (mg/L)		1.3±1.2	1.4±1.2	1.1±1.0

**Table 3: Measurements of water parameter in all treatment of Phase 2**

Parameter		Treatment						Control
		0.0LP20		0.5LP20		1.0LP20		
		0.1	0.25	0.1	0.25	0.1	0.25	
Temp. (°C)	AM	26.4±0.9	26.4±0.8	26.4±0.8	26.4±0.8	26.5±0.8	26.4±0.8	26.4±0.9
	PM	28.0±1.2	27.9±1.2	27.8±1.2	28.0±1.2	27.1±3.0	27.8±1.1	27.8±1.2
pH	AM	7.9±0.3	8.0±0.4	8.0±0.4	8.0±0.4	8.0±0.4	8.0±0.4	8.0±0.4
	PM	8.1±0.3	8.2±0.3	8.2±0.3	8.2±0.3	8.1±0.3	8.2±0.3	8.1±0.3
Alkalinity (mg/L)		147.7±22.0	162.2±23.4	162.2±22.0	139.8±19.1	162.2±28.8	149.9±33.4	153.3±23.4
TAN (mg/L)		0.3±0.3	0.6±0.6	0.4±0.4	0.4±0.4	0.3±0.4	0.5±0.7	0.4±0.4
N-NO <sub>2</sub> <sup>-</sup> (mg/L)		1.3±0.9	1.0±1.3	1.1±0.9	1.2±1.0	1.2±1.0	1.3±0.7	1.3±1.1

**Table 4: Growth performance and survival rate of PL<sub>1-15</sub> shrimp.**

Parameter	0.0-LP20	0.5-LP20	1.0-LP20
Final Weight of PL <sub>15</sub> (g)	0.0048±0.0005 <sup>a</sup>	0.0060±0000 <sup>b</sup>	0.0068±0.0005 <sup>c</sup>
Length of PL <sub>15</sub> (mm)	9.83±0.36 <sup>a</sup>	10.53±0.34 <sup>b</sup>	10.74±0.31 <sup>b</sup>
Amount of feed (g)	128.4±0.65 <sup>a</sup>	126.6±0.25 <sup>a</sup>	125.5±0.48 <sup>a</sup>
Survival rate of PL <sub>15</sub> (%)	43.7±4.7 <sup>a</sup>	49.8±3.8 <sup>b</sup>	53.9±2.5 <sup>b</sup>
Shape uniform of PL <sub>15</sub> (%)	100	100	100
Colour uniform of PL <sub>15</sub> (%)	100	100	100

**Table 5: The growth performance in length (mm) of shrimp PL<sub>16-45</sub>**

Treatment	Initial	30 days	45 days	DLG (mm/day)	SGR <sub>L</sub> (%/day)
0.0LP20-0.1	10.1±0.24 <sup>a</sup>	20.9±1.6 <sup>a</sup>	37.4±0.57 <sup>b</sup>	0.98±0.12 <sup>abc</sup>	4.60±0.29 <sup>abc</sup>
0.0LP20-0.25	10.1±0.24 <sup>a</sup>	23.1±2.7 <sup>a</sup>	38.5±2.02 <sup>bc</sup>	0.98±0.13 <sup>abc</sup>	4.61±0.32 <sup>abc</sup>
0.5LP20-0.1	10.1±0.24 <sup>a</sup>	22.1±1.9 <sup>a</sup>	37.6±0.31 <sup>bc</sup>	1.105±0.19 <sup>c</sup>	4.89±0.44 <sup>c</sup>
0.5LP20-0.25	10.1±0.24 <sup>a</sup>	20.4±1.6 <sup>a</sup>	37.6±0.63 <sup>bc</sup>	0.89±0.44 <sup>ab</sup>	4.38±0.13 <sup>ab</sup>
1.0LP20-0.1	10.1±0.24 <sup>a</sup>	20.3±0.7 <sup>a</sup>	37.6±0.30 <sup>bc</sup>	1.03±0.07 <sup>bc</sup>	4.73±0.17 <sup>bc</sup>
1.0LP20-0.25	10.1±0.24 <sup>a</sup>	20.6±1.7 <sup>a</sup>	39.2±0.77 <sup>c</sup>	0.97±0.02 <sup>abc</sup>	4.58±0.05 <sup>abc</sup>
Control	10.1±0.24 <sup>a</sup>	20.9±1.6 <sup>a</sup>	35.2±0.77 <sup>a</sup>	0.85±0.04 <sup>a</sup>	4.25±0.13 <sup>a</sup>

**Table 6: The growth performance in weight (g) of shrimp (PL<sub>16-45</sub>)**

Treatment	Initial	30 days	45 days	DWG (g/day)	SGR (%/day)
0.0LP20-0.1	0.0062±0.001 <sup>a</sup>	0.059±0.008 <sup>a</sup>	0.47±0.02 <sup>ab</sup>	0.018±0.005 <sup>a</sup>	21.9±0.13 <sup>ab</sup>
0.0LP20-0.25	0.0062±0.001 <sup>a</sup>	0.089±0.12 <sup>b</sup>	0.48±0.06 <sup>ab</sup>	0.018±0.005 <sup>a</sup>	22.0±0.40 <sup>ab</sup>
0.5LP20-0.1	0.0062±0.001 <sup>a</sup>	0.06±0.015 <sup>a</sup>	0.45±0.04 <sup>ab</sup>	0.015±0.006 <sup>a</sup>	21.7±0.29 <sup>ab</sup>
0.5LP20-0.25	0.0062±0.001 <sup>a</sup>	0.07±0.02 <sup>ab</sup>	0.45±0.05 <sup>ab</sup>	0.015±0.006 <sup>a</sup>	21.8±0.39 <sup>ab</sup>
1.0LP20-0.1	0.0062±0.001 <sup>a</sup>	0.06±0.01 <sup>a</sup>	0.45±0.08 <sup>ab</sup>	0.015±0.006 <sup>a</sup>	21.9±0.55 <sup>ab</sup>
1.0LP20-0.25	0.0062±0.001 <sup>a</sup>	0.077±0.007 <sup>ab</sup>	0.52±0.05 <sup>b</sup>	0.02±0.001 <sup>a</sup>	22.3±0.30 <sup>b</sup>
Control	0.0062±0.001 <sup>a</sup>	0.056±0.005 <sup>a</sup>	0.403±0.05 <sup>a</sup>	0.013±0.005 <sup>a</sup>	21.5±0.38 <sup>a</sup>

**Table 7: Survival rate, feed conversion ratio and shrimp quality at the stages of PL<sub>16</sub> to PL<sub>45</sub>**

Treatment	Survival rate PL <sub>45</sub> (%)	FCR	Size uniform of PL <sub>45</sub> (%)	Color of PL <sub>45</sub>
0.0LP20-0.1	93.6±4.5 <sup>a</sup>	1.41±0.62 <sup>ab</sup>	90	Normal
0.0LP20-0.25	95.1±3.3 <sup>a</sup>	1.37±0.21 <sup>a</sup>	90	Normal
0.5LP20-0.1	95.6±2.7 <sup>a</sup>	1.46±0.14 <sup>ab</sup>	90	Normal
0.5LP20-0.25	94.4±4.4 <sup>a</sup>	1.48±0.23 <sup>ab</sup>	90	Normal
1.0LP20-0.1	97.3±3.4 <sup>a</sup>	1.44±0.22 <sup>ab</sup>	90	Normal
1.0LP20-0.25	97.6±0.9 <sup>a</sup>	1.23±0.11 <sup>a</sup>	90	Normal
Control	93.9±3.5 <sup>a</sup>	1.66±0.17 <sup>b</sup>	90	Normal

# Operational Conditions of Anaerobic Digestion and their Optimization for Enhanced Biogas Production – A Review

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**Abstract-** In 21<sup>st</sup> century, sustainable development has a colossal and crucial role to play in global environmental apprehensions such as GHG emission from fossil fuel combustion, damage to the environment by the haphazard disposal of waste. Under these current circumstances, biogas production technology has flourished and has proved to be a meritorious success story today. Biogas is produced by microbial anaerobic digestion of organic wastes such as animal waste, plant material, sewage crops etc. Biogas principally comprises of 50%-60% of methane and 25%-45% of CO<sub>2</sub>. In the recent past, research on this technology has been limited to some extent due to the complex phenomenon existed with various factors and parameters influencing it. Optimization of parameters like organic loading rate, pH, C/N ratio, total solids, volatile solids content hydraulic retention time and temperature of the digester will have a synergistic effect on the yield. Adopting the principle of co-digestion, for biogas production from mixture of wastes is found to be an effective solution for optimization of various factors. Hence, this paper reviews the research carried on biogas production from various bio degradable waste mixtures in different operational conditions. This review has also emphasized on several physical, thermo-chemical and biological pre-treatments and alterations carried during the anaerobic digestion for enhance result. Micronutrient supplementation for the mixture of wastes is expected to have a synergistic effect on microbial growth. The future research in renewable energy studies targeting this arena are the need of hour

**Index Terms-** Biogas: Anaerobic digestion, Renewable energy, Micronutrient supplementation.

## I. INTRODUCTION

Sustainable development is the major agenda for the developing countries like India. Environmental challenges are arising from the disposal of waste produced by the anthropogenic activities. Methods like anaerobic digestion will serve as a green alternative to treat these wastes. Anaerobic digestion workstation ends up with carbon dioxide and methane production. Amplifying the methane content of biogas is one of the existing goals of bio gasification research, methanogen bacteria convert organic compounds to methane [2]. Co digestion of waste material is generating unsought difficulties like bacteria inhibition, toxicity etc., particularly in biogas production [5].

Taking in to account the huge water and biological content, they decompose quickly and end up with rotten stink. The procedure is broadly used for energy production because the methane-rich biogas produced is treated a renewable energy resource. [3] A typical example is the anaerobic digestion of vegetable and fruit residues, the availability of which is dependent upon both climatic conditions and the season of the year. Therefore assessing the potential contribution of co-digestion in alleviating any adverse economic impacts of feedstock seasonable variability will also require an in-depth understanding of the effects of operating anaerobic digesters in time variant cycles involving one or more of the contributing feedstock [10]. Qualitative and quantitative improvement of biogas and methane yield from anaerobic co-digestion is known to show high stability. The thermal analysis technique is proven to be a novel and practical tool for assessing the stability of biological residues [11]

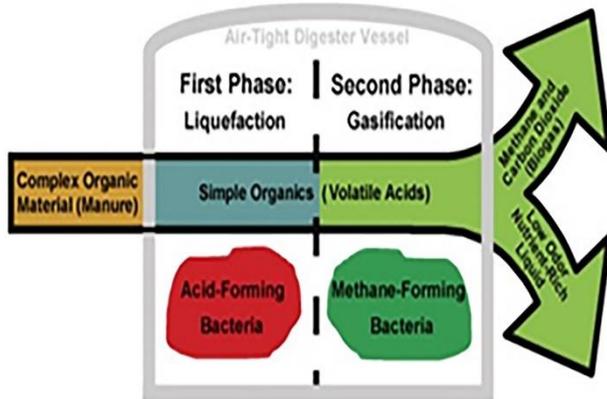
**1.1 Anaerobic digestion:** Anaerobic digestion can be used to breakdown biodegradable waste and convert to energy. Methane is a biogas that can be efficiently converted in to electricity [12]. Anaerobic Digestion (AD) is carried out in the absence of oxygen and it ends up with methane generation and treats waste for environmental welfare. Total atmospheric methane exhalation ranges from 15% to 45 % are mainly based from flooded soils with 100-200 CH<sub>4</sub>Tg per year, Cattle (65-100 Tg/y) and rice fields (25-150 Tg/y) [13] Four different steps: hydrolysis, acidogenesis, acetogenesis, and methanogenesis are the main reduction process involves in AD listed in “fig 1” [14]

**Hydrolysis:** Process carried out by bacteroides, clostridia and facultative bacteria that involve transformation of insoluble organic material in to soluble compounds. Importance of this stage is very high due to degradation of large organic molecule by microorganism and degradation rate is highly depended able on nature of substrate

**Acidogenesis (acidification phase):** During this stage, simplified organic compounds taken over by facultative and obligatory anaerobic bacteria end up with formation of organic acids, alcohols and hydrogen production

**Acetogenesis:** During this process organic matter which cannot be converted to methane by methanogenic bacteria were supplemented in to methanogenic substrate. Later on, acetate bacteria convert the acid phase products into acetates and hydrogen

**Methanogenesis:** Most important chemical conversion process among entire anaerobic digestion end up with methane and carbon dioxide. [17]



**Fig 1. Biogas production methodology**

### 1.2 Different waste material for biogas production

**Animal waste:** The capability of cow dung for biogas production was explored, effective methodology to utilize cow dung for biogas production was reported [23] poultry waste yields biogas, around 60% methane, 38% carbon dioxide because of the high availability and it is an easy method for disposal [24] swine manure is the major source of toxic gas emission and foul smell generation, biogas production can be a promising technology to rectify the same [25]

**Vegetable waste:** Higher Moisture content in the vegetable waste promotes the anaerobic digestion. Fruit and vegetable wastes co digestion with cow dung is an alternative way to improve biogas production, elemental analysis of vegetables waste showed (65–70%) of biodegradability as a feedstock for anaerobic digestion [26]

**Agriculture waste:** Rich in carbon and nitrogen making them suitable for biogas production. Studies reports shows various methods for utilizing agricultural and forestry waste in Europe, energy value of Europe from biodegradable waste estimated to  $4.5 \times 10^{12}$  MJ/year. Greenhouse gas, big threat to climatic change should be reutilized with various methods comprise aerobic digestion and anaerobic digestion. Studies shows and average range between  $(18,630 \text{ KJ/m}^3 - 26,081 \text{ KJ/m}^3)$  energy can be derived from bio waste yearly. Anaerobic methods happens in open atmosphere release methane gas to environment directly and leads to drastic climatic changes more than carbon dioxide, methane gas can be produced using bio digesters [15]

## II. REVIEW OF THE CO DIGESTION MATERIALS

SajeenaBeevi.B, et al utilized organic municipal waste degradation with a retention time of 100 days under room temperature. Fabricated digesters of 2 liter capacity were used at anaerobic condition and the contents were restricted to 1.6 liters. pH inside the digester decreased initially, due to higher volatile fatty acid concentration in municipal solid waste. Hence regular pH alteration were carried out to maintain range 6.8 to 7.4 using 6N NaOH buffering solution. Results have revealed decreased Biogas production with reduction in substrate concentration and

low C/N ratio. Municipal waste after final degradation was suitable for organic manure. Organic loading rate of 99gm TS/liter was optimum for efficient degradation of municipal solid waste [1]

Salma A. Iqbal et al studies on anaerobic digestion of kitchen waste with cow dung reported positive. The study was conducted to evaluate the influence of organic loading rate and temperature on biogas production. The experiment is initially carried out at atmospheric temperature and later on at constant temperature of 37°C. Maximum yield of biogas production is noticed at constant temperature. OLR at 200gm/L had higher yield than other loading rates. 0.8 – 5.5 times increase in the biogas yield is noticed due to co-digestion when compared to mono digestion. The experiment has also studied the effect of sodium hydroxide addition to increase biodegradability and bio gas production, with different NaOH doses of 1.0%, 1.5% and 2%. Optimum output obtained at 1.5% NaOH solution. [4]

Sanaei-MoghadamA et al made a study on biogas production using potato pulp and cow dung, the experiment is conducted to evaluate energy production from potato waste collected from chips factory, by introducing laboratory plant setup of Continuous Stirred Tank Reactors (CSTR) to different ratios of substrate 20:80,50:50,80:20,0:100 (potato :cow manure). Parameters like (pH, temperature, water content, stirring) were maintained within in the optimum range for gas production. Adding sodium bicarbonate solution with 10% concentration to all substrates for maintaining pH was done throughout the process. Finally, the best methane results was production of 348L (kg/VS) from the ratio of 20:80, with a methane quality of 62.1%. Other combinations yielded more bio gas than cow manure alone [5]

Xue Qin et al has conducted an experiment to study the biogas production potential of 12 food wastes, which are divided into 4 categories i.e., staple food, vegetables, meat and fruits. Digesters were placed inside water bath and maintained at constant temperature of 35°C with a speed of 100 rpm inside and biochemical methane potential test was carried out to find out methane yield. Initial pH was measured and Na<sub>2</sub>CO<sub>3</sub> buffer solution was added at regular intervals to maintain the pH around 7. Carbohydrates content was high in vegetables, protein was abundant in meat and fruits had high moisture content. Fermentation nature for food substrate varied with total days of HRT. Final results showed that all pH values ranged from 7.02-7.35 lowest being for apple waste and highest for cooked chicken respectively. Final ammonia concentration of vegetables, chicken and steamed bread had increased which ranged from 60.46 to 259.8 mg ammonia –N/L, and showed no major impact on anaerobic digestion with this huge variations methane quality is better for meat waste [6]

Marta Oleszekl et al studies from biogas production from waste materials which are unsuitable for the preparation of silage due to low sugar and high protein content. Waste material mainly consisted of cucumber and tomato residues in the form of shoot stems and leaves. Post fermentation sludge collected from active agricultural biogas plant was used as inoculums with substrate ratio of (1:1). Studies were carried out with different combinations of fresh substrate, ensiled residues and inoculums under controlled parameters like temperature maintained at 37°C, pH at 7 (initially) and total solids and volatile solids of

inoculums showing 3.8 and 2.5% respectively. Volume of biogas was measured on a daily basis by water displacement method. Samples of tomato and cucumber residues were dried, milled and made into capsule form using tablet press. Later on, lower heating values were calculated with moisture level (0%, 25%, 75%) for calorimetric analysis, results showed fermentation of fresh tomato residue yielded maximum (606.9 ml g<sup>-1</sup> VS) and ensiled cucumber waste was the least (327.3 ml g<sup>-1</sup> VS). Ensiled waste began to ferment faster than fresh residues and best biogas quality was obtained from fresh cucumber. [7]

Xumeng Ge et al has studied anaerobic digestion of tropical biomass like forestry waste, alibiza and food waste limited to taro, papaya and sweet potato for conversion of waste into green energy. The experiment is carried in two different conditions i.e., solid state AD and liquid state AD. Reaction temperature was kept at 37°C with constant stirring mechanism kept at 100 rpm for all digesters. Biogas composition and volume was measured every 2 days and hydraulic retention time was maintained for 24 days. Pretreatment methods were opted with environmental fungi to speed up reaction rate and methane yield. Co digestion of different combinations of papaya, sweet potato, taro and taro skin values ranges with 371 to 411 kg<sup>-1</sup> VS and methane yield varied initially but became linear after 8 days. Methane yield from food waste content reached within the limits of 70%-80% which is much greater when compared to yield derived from fallen tree leaves of Alibiza and chips. Anaerobic digestion of Alibiza showed highest volumetric production compared to other tropical bio waste. Thus, it can be concluded that this has a promising future in the field of bio energy inputs. [8]

Eficio Antonio Scan et al studied the biogas production from the anaerobic mono substrate digestion of fruit and vegetable wastes. The temperature is maintained at mesophilic conditions (35 ± 0° C) throughout the study with a HRT of 27 days. The optimum OLR is 2.5 to 3.0 Kg VS/m<sup>3</sup> and the average biogas production was about 0.78 Nm<sup>3</sup>/Kg VS. The optimum combination was used to evaluate the performance of a full scale power plant. [9]

Zhang Zhengyun, et al carried research was on anaerobic digestion for methane production from banana stalk and peel with different concentration ratios at mesophilic temperature (35°C). The main obstacle during initial days was acidification due to organic acids developed by hydrolytic bacteria. After the 12<sup>th</sup> day of conducting the process, methanogenic bacteria was getting cultivated more and overcame low pH due to initial acidification. Different concentrations of banana stalk and peel (5% and 7%) were used for both digesters and it was observed that increase in concentrations delayed biogas production. To attain peak condition, the process favored cumulative gas production. Banana stalk showed an average gas production of 6788 ml from 400 ml substrate with a total hydraulic retention time (HRT) of 58 days to arrive at a figure of 230 ml per day as maximum gas production. Comparative study showed that banana peel failed to meet gas production at initial days due to higher sugar content present in it, but later on, the process achieved a gas production of 5620 ml with a biogas yield showing 65% of methane. [16]

Gizem Alkanok, et al article outlines the best methods for waste disposal from supermarkets in Turkey. Studies materials like fruits, flowers, vegetable waste (FVFW), and dairy product

waste (DPW), mixed waste (Mix.W), meat waste and sugar cane waste. Experiments were carried out using two sets of digesters named (R1-R2, R3-R4, and R5-R6, R7-R8) Substrate inoculum ratio was restricted to (9:1) with an average pH alteration using 1N potassium hydrogen carbonate (KHCO<sub>3</sub>). The temperature was maintained at 37°C and daily gas production was measured using water displacement technique. Highest gas production observed was from FVFW having 6175 ml with 57.6% methane composition. The paper investigates on proper methods of waste disposal and prevention of greenhouse gases, which are being exposed into the atmosphere. [18]

Dinh Duc Nguyen et al energy production through the technique of 'dry semi continuous anaerobic digestion' (DScAD) on food waste which has shown admirable results. DScAD method is carried out using 20 liter digester bottles with external jacket that can circulate hot water to maintain the whole unit at 55°C. Continuous mixing maintained at 30 RPM was carried out to make the substrate homogeneous. FW waste limited to 60 kg with an organic loading rate (OLR) varying from (3.8 kg-VS/m<sup>3</sup> day to 9.8 kg-VS/m<sup>3</sup> day). Total experimental work was divided into 4 phases. The first two phases had temperature maintained at 38°C, whereas during the last two phases, a temperature of 55°C was maintained with a gradual increase of 2°C periodically. Owing to the presence of ammonia (3g/liter) in the substrate the results for the check of bacterial growth showed positive. (Ammonia facilitates the growth of methanogenic bacteria). Modified Gompertz model of regression analysis was carried out for prediction and comparison of biogas production. Organic loading rate (OLR) ranged from (7.5 to 8.4) VS/m<sup>3</sup> per day and this obtained the highest amounts of volatile fatty acid (VFA) concentration with an average methane yield of 62%. If monitored diligently, 15,330 kWh of energy can be produced in a year from 1 m<sup>3</sup> size DScAD plant, which equals 1.16 tons oil per year. This study shows that the technique of using DScAD is 11.6 times more efficient than carrying out the same in an ordinary anaerobic digester in wet conditions [19].

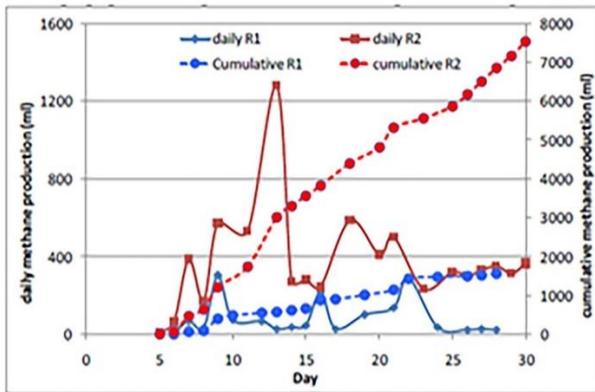
N.V. Deshpande et al described biogas production from Mahua and Hingan non edible de oil cake waste with cow dung in different ratio. Single-phase digestion system with working volume of 20-l transparent plastic bottle designed for experimental work, anaerobic digestion was carried out, in mesophilic temperature scaling from 20°C to 40 °C. Optimum biogas yield found maximum between 36°C to 40°C and methane ranges 68-72%. Author has reported presence of minerals like copper, iron, zinc, manganese, calcium and magnesium in the digested slurry of Mahua and Hingande oil cake. Hence, it is fit for agriculture purpose [28].

### III. FACTORS INFLUENCING THE BIOGAS PRODUCTION

A number of outside parameters make a powerful result on the biogas production by anaerobic bacteria. Parameters like co-digestion, temperature inside digester, pH, Hydraulic retention time, and variation in organic loading rate has an enormous impact on biogas production, average biodegradation of waste material can be done with proper environment creation on bacteria growth. Parametric study is a possible option for capable management of anaerobic digestion

**3.1. Effect of co digestion**

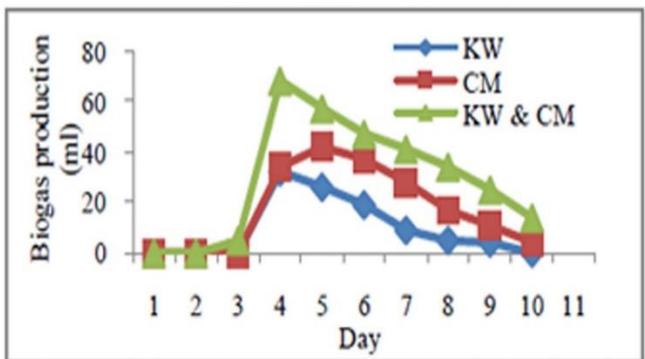
Cindy Priadi et al, observed a gradual increase in the quantity and quality of the biogas production by the co digestion of paper sludge with cow dung. Anaerobic digestion (AD) of paper sludge alone produced 14.7 mL/g VS when compared to methane production from sludge seeded with cow manure of 269 mL/g volatile solid (VS). The cumulative production of Reactor 2 showed 3.5 times more than Reactor 1 in “fig.2” (a) [20]. Different waste material co digestion for biogas production reported [22].



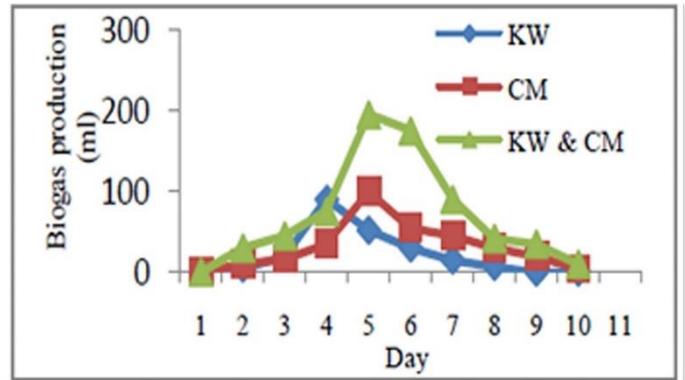
**Fig 2 (a) daily and cumulative biogas production R1=Reactor one containing only paper sludge and R2= reactor 2 containing paper sludge and cow manure**

**3.2. Effect of temperature inside digester**

Initially, work was carried out at atmospheric temperature and later on at constant temperature of 37°C for biogas production from co digestion of kitchen waste with cow dung. Later experiment has produced more volume and showed stable gas production [4]. The variation is as shown in the Fig”3 (a)”, “3(b)”



**Fig 3(a) different digesters biogas production (ml) with atmospheric temperature**



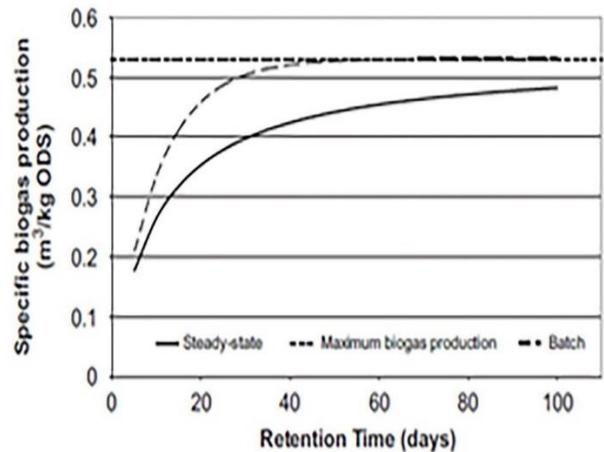
**Fig 3(b) different digesters biogas production (ml) at 37°C constant temperature**

**3.3. Effect of pH alteration in biogas production**

The chemical balance of substrate must be maintained at neutral range for proper growth and multiplication of bacteria. Acidic condition inside working digester may destroy anaerobic bacteria, end up in failure of whole biogas production. Perfect pH alteration by sludge recirculation is reported [21]. M. Saev, B et al, explained the addition of chemicals will alter biogas yield from the anaerobic digester due to their response on the variation of pH. To sustain pH between 6.7 to 7.9 throughout experiment, NaOH solution insertion at regular interval was reported [29]. In addition, to prevent harmful effects due to acidification and volatile fatty acid accumulation, sodium bicarbonate solution (NaHCO3) is added to correct the process [30]

**3.4. Effects of hydraulic retention time**

Average time reported to undergo liquid sludge inside digester is hydraulic retention time (HRT). The relationship between gas production, breakdown efficiency and retention time is mostly studied on laboratory scale, [31]. A study of HRT shows maximum daily biogas production curve obtained between 16-25 days and find linear till 40-50days [27]. Relation between specific gas production and HRT shows in “Fig4” (a)



**Fig 4(a) Bio gas production with Hydraulic retention time**

#### IV. CONCLUSION

Although many experiments were carried for biogas production from various biodegradable waste materials, in this view point, canteen waste disposal need more attention. Vegetable left over with tea waste in different substrate ratio for anaerobic digestion is still unexplored. Both of these wastes are being profusely disposed by humans, there is a huge demand for an advantageous method of efficient bio gas production. Alternative energy generation from biogas will in turn reduce greenhouse gas emission helping to combat the climatic change. Alteration to the process reviewed in this paper can be made to build up a victorious implementation in the meadow of biogas production

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# An Enhanced Routing Technique for Node Mobility and Density Classifier in Mobile Ad hoc Networks

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**Abstract**—Mobile phones are most common way of communication and accessing internet based services. A mobile ad-hoc network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless. Essentially ad hoc network is a collection of nodes communicating with each other by forming a multi-hop network. Each must onward traffic unconnected to its own use and consequently be a router. The primary aim is a MANET is to build the each device to incessantly preserve the information necessary to correctly route traffic. Mobile Ad-Hoc Network (MANET) is often susceptible to security attacks due to its features of open medium, limited physical security, dynamic changing topology and cooperative algorithms, lack of centralized monitoring and organization point, energy constrained operations and often lacks of a clear line of defense.

**Index Terms**—Density Classifier, LFR, NMDC

## INTRODUCTION

Internet is a worldwide collection of computer networks. Internet is a cooperative effort of many people and organizations. The computers on the Internet can communicate because they are physically linked and because they share a common language called TCP-IP language that two computers use to communicate[1]. This definition describes acceptable messages and outlines the rules that two computers must follow to exchange those messages. The major transport protocol in Internet Protocol suite. It provides reliable communication between two computers in the network. The network protocol in the internet IP provides a best effort to deliver an IP packet between two networks on the Internet.

## Mobile Ad-Hoc Network

A Mobile Ad-hoc Network (MANET) is associated through wireless and it is a self-configuring transportation less network mobile devices. Every device in the MANET can move separately in any direction and also will modify its links with other devices normally. A MANET is a self-determining collection of mobile users that write over relative bandwidth controlled wireless links. Since the network topology may change quickly and suddenly over time. Network is decentralized while all network activity has discovering the topology and 4 delivering messages are executed with the nodes themselves. Ad-hoc networks are usually collected of equal nodes that communicate over wireless links exclusive of any central control.

## Life Time Forecast Routing (LFR)

The power constrained is one of the main design constraints in MANET and all effort is to be channel towards reducing power. Moreover network generation is a key design metric in MANETs. Since every node has to perform the functions of a router, if some nodes pass away early due to lack of energy and it will not be probable for other nodes to communicate with each other. Hence the network will get disjointed and the network lifetime will be unfavorably affected. It has the lifetime of prediction routing protocol for MANETs that maximizes the network lifetime with sentence routing solutions that minimize the inconsistency of the remaining energies of the nodes in the network.

## LITERATURE SURVEY

Mobile Ad-hoc Networks (MANETs) to minimize redundancy, contention. In order to propose this works various literatures which are relevant and helpful to do this work are reviewed and analyzed are presented the network support applications. The main application in wireless sensor networks characterizes the event detection. It is used to modeling and simulating wireless sensor networks and also the authors have the software[2].

The immunity based security architecture and the detection agent in our architecture based on T-cell is responsible nodes in network can be as B-cell Li Hinlai et al., developed it can produce a large number of antibodies that are activated counter attack agent to clear the antigen with cooperate directly with the invader. KrishnaPriya et al., identified the compromised nodes in the ad-hoc networks

GSR[3]. It is overcome using threshold cryptography and Chinese Remainder Theorem.

The critical challenges in wireless sensor networks (WSNs) to energy conservation. A distributed topology protocol with transmission power alteration based on harmony search and learning automata algorithms called HSLATC (Harmony Search and Learning Automata based Topology Control Protocol) [4]. It has proper transition radius of the sensor nodes that can be resolute. Throughout the intelligent determining the transition radiuses of the nodes in the HSLATC protocol. It can able to offer the full connectivity in sparse consumption and reduce the energy consumption of the sensor network and prolongs the network lifetime.

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A Mobile Ad hoc Network (MANET) is a group of autonomous self-organized nodes. The use of wireless medium for communication that two nodes can communicate directly. An emerging area has recently captured more attention in network routing researches is Swarm Intelligence (SI). The acceptance of SI for MANET routing refers to difficult behaviors that occur from very simple individual behaviors and interactions[5]. Each individual has little intelligence and just follows basic rules using local information obtained from the environment. The ants routing be similar to fundamental method from distributed SI in biological systems. It gaining more popularity as of its adaptive and dynamic nature.

An efficient ID a novel architecture that is to detect active attacks against AODV protocol in MANET. This architecture resides in the use of Finite State Machines for particular AODV routing behavior and distributed network monitors for detecting the attacks. It can detect the attacks and require more than one hop information[6]. The authors evaluate the EID architecture beside RID architecture against percentage of detecting the attacks both in static and dynamic case

### III. LIFE TIME FORECAST (LFR) ROUTING

The power constrained is one of the main design constraints in MANET and all effort is to be channel towards reducing power. Moreover network generation is a key design metric in MANETs. Since every node has to perform the functions of a router, if some nodes pass away early due to

lack of energy and it will not be probable for other nodes to communicate with each other. Hence the network will get disjointed and the network lifetime will be unfavorably affected. It has the lifetime of prediction routing protocol for MANETs that maximizes the network lifetime with sentence routing solutions that minimize the inconsistency of the remaining energies of the nodes in the network.

#### 3.1 Density Classifier

Mobile ad hoc networks range from established MANETs somewhere end-to-end paths exist from sources to destinations. For DTNs where no contemporary end-to-end paths exist and communication is achieved by the store, carry, and forward model of routing. The nodes of these networks require identifying the level of connectivity of the network they belong to and classify it as a MANET. A DTN in order to properly select appropriate protocols to achieve end-to-end communication.

Wireless networks are fast popularity to its peak today in the users want wireless connectivity irrespective of their geographic location. There is an increasing threat of attacks on the MANET. Black hole attack is one of the security threat in which the traffic is broadcast to such a node that in reality does not exist in the network. An analogy to the black hole in the universe in which things vanish. The node presents itself in such a way to the node that it can attack other nodes and networks knowing that it has the shortest path. MANETs must have a secure way for communication and communication which is quite demanding and vital issue.

To develop the performance of immediate routing protocols in MANETs the Bayesian classifier model has been used. It can help to enlarge the network throughput and decrease end-to-end delay through controlling the broadcast area. Further information connected to hop-counts and node densities are used to support routing protocol in broadcasting. The number of control packets distributed during route discovery process decreased significantly in comparison with conventional scheme.

A MANET is a collection of nodes forming rapidly changing topologies. MANETs are exposed as to its fundamental characteristics such as open medium, dynamic topology, distributed co-operation and constrained capability. Real time Intrusion detection architecture for detecting the attacks in mobile ad hoc networks. The main difficulty in this approach is that the detection mechanism process relies on a state based misuse detection system. It does not make use of a distributed architecture to detect attacks and it requires more than one hop information. It also occupy the use of finite state machines for specifying AODV routing behavior and distributed network monitors for detecting the attacks.

MANETs are wireless networks without fixed infrastructure based on the cooperation of independent mobile nodes. The proliferation of this networks and their use in

critical scenarios require new security mechanisms and policies to guarantee the integrity, confidentiality and availability of the data transmitted. Intrusion detection systems used in wired networks are inappropriate in this kind of networks. Since different vulnerabilities may materialize suitable to resource control of the participating nodes and the nature of the communication. It has the comparison of the effectiveness of six dissimilar classifier to detect malicious behavior in MANETs.

### 3.2 Lifetime Forecast Routing (LFR) with Node Mobility and Density Classifier (NMDC) for MANET.

A mobile ad hoc network is a movable, multi-hop wireless network by no fixed infrastructure. Dynamic topologies because of mobility and limited bandwidth and battery power build the routing difficulty in ad hoc networks more demanding than conventional wired networks. A key to develop efficient routing protocols for such networks lies in keeping the routing overhead negligible. A novel category of on-demand routing protocols such as DSR, AODV, TORA try to decrease routing overhead through only maintaining routes among nodes taking part in data communication.

Energy aware and link stable paths turn out to be key issues in designing scalable routing protocols in mobile ad hoc networks (MANETs). The objective of this work is the proposal of a new routing model which could be able to account for a joint metric of more link stability and less energy consumption in MANET.

Energy is a significant resource that needs to be preserved in order to extend the lifetime of the network. In contrast, the link and path stability among nodes permits the diminution of control overhead and could offer some benefits also in terms of energy saving over MANET. However, as will be shown in this work, the choice of more stable routes below nodes mobility could direct to the choice of shorter routes. This is not forever appropriate in terms of energy consumption. Conversely, on occasion, attempting to optimize the energy could lead to the choice of more weak routes. Therefore, it is obvious that both the abovementioned parameters (specifically, link stability linked with the nodes mobility and energy consumption) must be measured in designing routing protocols, which permit right tradeoff between route stability and least energy consumption to be attained.

#### Node Mobility and Density Classifier (NMDC)

Mobile ad hoc networks have gained a set of interest lately in the investigate community. On the other hand, owing to the different node mobility patterns and density of nodes, such networks have dissimilar connectivity patterns. In conventional MANETs it is implicit that end-to-end paths subsist from any source to any destination most of the time. In recent times, there has been an endeavor to classify the various types of mobile nodes assuming there is a centralized influence that has whole information of the network and its dynamics. In this work we give a new that classifies density of

network and node mobility patterns. This approach provides an attractive insight on the way that mobile nodes operate but it is not practical due to the hypothesis of the centralized mechanism doing the classification.

#### Node Mobility and Density Classification(NMDC)Algorithm

The Node mobility and density classification algorithm which is based on analytically calculated formulas and simple node observations. First, we present the assumptions and some definitions of quantities that are used

throughout the Node Mobility and Density algorithm and then we present the NMDC algorithm

#### Algorithm 1: NMDC

```
Step 1: Estimate the number of nodes N  
Step 2: For each node in N  
Step 3: Apply node mobility classifier  
Step 4: Identify slow state nodes  
Step 5: Identify Medium state nodes  
Step 6: Identify High state nodes  
Step 7: Apply Node density classifier  
Step 8: Evaluate grid nodal size  
Step 10: Based on optimized grid nodal size  
Step 11: Segregate zonal areas  
Step 12: Apply non linear programming  
Step 13: Find stable link path
```

#### Lifetime Forecast Routing (LFR)

Lifetime Forecast Routing (LFR) is an on demand source routing protocol that employs battery lifetime Forecast. The objective of this LFR routing protocol is to make bigger the service life of MANET.

#### Algorithm 2: Functionality in intermediate node

```
Step1: For Intermediate Node i,  
Step2: Forecast lifetime LT,  
Step3: If  $LT < \text{Min}(LT)$   
    Replace  $\text{Min}(LT)$  with its LT  
    End if  
Step4: If Sequence Number (SNO) exists  
    Compare  $\text{Min}(LT)$  of current with  $\text{Min}(LT)$   
    If new  $\text{Min}(LT) \leq \text{old Min}(LT)$   
    Discard new RREQ  
    End if  
Step5: If new  $\text{Min}(LT) > \text{old Min}(LT)$   
    Replace old  $\text{Min}(LT)$  with new  $\text{Min}(LT)$   
    Forward new RREQ  
    End if  
    End if  
Step6: If SNO does not exist  
    Save this  $\text{Min}(LT)$   
    Forward RREQ  
    End if  
    End for
```

Performance Evaluation of Lifetime Forecast Routing with Node Mobility and Density Classifier.

The performance of proposed Lifetime Forecast Routing with Node Mobility and Density Classifier (LFR-NMDC) Model in a mobile ad hoc network.

Table: 1 Parameters used during simulation

Parameters	Value
Area	1000*1000 m
No. of nodes	100-1000
Simulation duration	900 sec
No. of repetition	5 times
Radio transmission range	100 m
Physical/Mac layer	IEEE 802.11
Pause time	30 sec
Mobility model	Random direction model
Node movement	5 – 35 m/s
Data sending rate	2 Mbps
Each packet	512 bytes
Traffic Type	CBR

Table: 2 Node Lifetimes

Node Mobility (m/s)	Node Lifetime		
	Proposed LFR-NMDC	Existing LAER	Existing PERRA
5	98	82	73
10	97	78	71
15	96	80	64
20	96	77	67
25	95	69	61
30	93	63	62
35	92	61	63

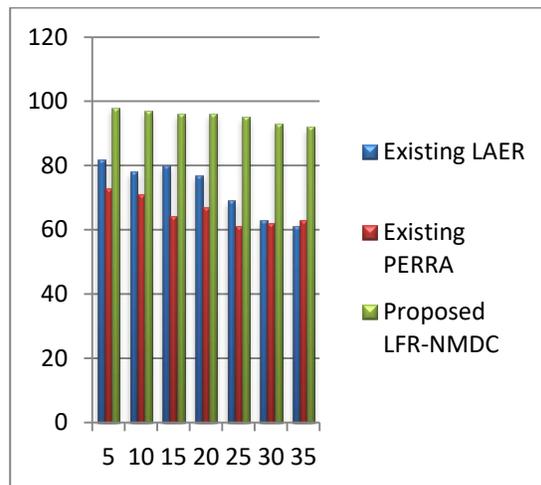


Figure: 1 Node Lifetime

Table 3: Normalized Control Overhead

Node Mobility (m/s)	Normalized Control Overhead		
	Proposed LFR-NMDC	LAER	PERRA
5	0.4	1.2	2.2
10	0.6	2.5	4.1
15	0.8	2.8	7.4
20	0.9	3.1	11.2
25	1.2	3.2	12.5
30	1.3	3.9	15.3
35	1.7	4.5	16.7

3.1 Normalized Control Overhead

The increase in the normalized control overhead for higher speed. It is possible to observe the good scalability of model based on the local topology knowledge such as LFR-NMDC and LAER. The technique applied to both models and the only local control packets exchange (HELLO pkts) determines a similar performance of LFR-NMDC and LAER differently by PERRA that is forced to start new route discovery procedure that increases the control overhead. The proposed LFR-NMDC attains 7-12% less control overhead when compared with LAER and it attains 10-57% less compared to PERRA.

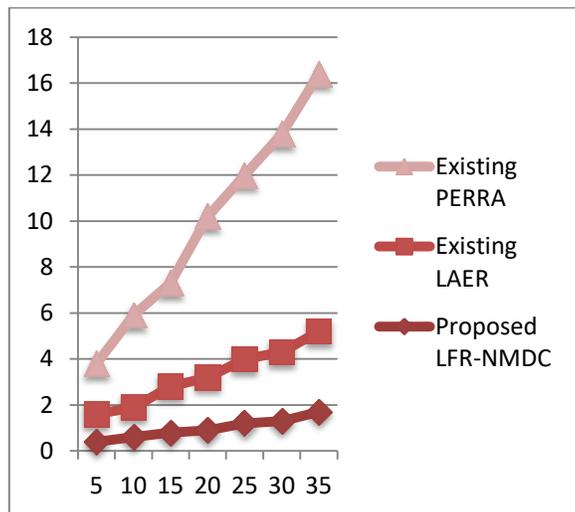


Figure2: Normalized Control Overhead

Table 4: Data Delivery Ratio

Number of Nodes	Delivery Ratio (%)		
	Proposed LFR-NMDC	LAER	PERRA
100	98.72	86.83	83.02
200	98.2	85.25	81.22
300	97.43	83.92	78.93
400	97.14	82.92	77.73
500	96.68	80.04	77.12
600	95.23	79.47	74.25
700	94.17	76.73	68.24

#### 4.1 Data Delivery Ratio

Delivery ratio of proposed LFR-NMDC model and existing LAER, PERRA protocols for different number of nodes is shown in Fig. 4.4. Data delivery ratio is the ratio between number of delivered data packets and the number of generated data packets in all nodes. Note that the number of generated packets is the expected number of generated packets. We generate as many as 10,000 data packets during the simulation. They are generated between random source and destination pairs at random times. Many of these might not have reached their intended destination because of lack of existence of a route between the source and destination for various reasons. Also, the network lifetime clearly affects this ratio. If the network is alive for longer time, it implies that more data traffic goes through since to establish random connections throughout the time of the simulation.

The proposed LFR-NMDC model improves further the performance increasing the data delivery ratio about 22-38% in comparison with LAER and about 25-41% in comparison with PERRA.

#### CONCLUSION

The Sparse and dense population of mobile nodes in a variety of position of the ad hoc network diminish delay of route discovery. An optimization routing model within MANET minimizes concurrently mobile node energy consumption and maximizes link stability of transmission paths. Topology control attempts to make a decision for every node the smallest amount broadcast power that sufficiently guarantees connectivity of the node. A cooperative authentication and topology control (CATC) scheme is proposed to improve the throughput of the consistent topological control.

A routing protocol called LFR with NMDC, based on the joint metric of link stability and energy consumption, has been proposed. The main objective of LFR-NMDC is to reduce the variance in the remaining energies of all the nodes and thus extend the network lifetime. It attains this by doing local decisions and with minimum control overhead. We demonstrate that LFR-NMDC brings about a clear enlarge in network lifetime.

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# Hygienic practices and quality of raw milk produced in a small scale dairy farming area in Sri Lanka

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**Abstract-** Sri Lankan domestic dairy production has shown a significant improvement in recent years but less attention is given for milk quality and hygienic practices. This study focused on evaluating the common hygienic practices and the quality of raw milk produced in Makandura (NWP) area. A total of 75 raw milk samples were collected from dairy farmers from three milk collecting centres (MCC), Mahayayawatta(MW); n=33, Makandura town area (MKT); n=22 and Pahala Makandura (PM); n=20, during the period from June to August 2013. All the samples were subjected to physicochemical, microbiological, platform, and keeping quality tests. Meanwhile all the farmers were interviewed using a pre-tested questionnaire to assess hygienic practices. There was no significant difference ( $p>0.05$ ) in all physicochemical quality parameters except Specific Gravity (SG) and Solid Non Fat% among milk received from three MCCs. The mean SG and pH values reported from all MCCs were within the acceptable ranges. There were significant differences ( $p<0.05$ ) in microbiological quality parameters among three MCCs and all of them were lower than the standards with highest counts reported from PM. Simultaneously, PM had the highest percentage of abnormalities in organoleptic qualities and the highest percentage of positive results from Alcohol test, clot on boiling test and Resazurine ten minutes test. Few farmers carried out recommended hygienic practices including post milking teat dipping (0% in all three MCCs), complete milking (MW,18%, MKT,23%, PM,16%) and fore milk rejection (MW,7%, MKT,23%, PM,5). Appropriate hygienic management practices must be practiced during all the stages of dairy production in order to improve the milk quality.

**Index Terms-** Hygienic practices, Microbiological quality, Physicochemical quality, Raw milk

## I. INTRODUCTION

In parallel to increasing demand, domestic dairy production has also shown a phenomenal growth during past two three years, mainly due to positive government involvement which encouraged local milk production (Department of Animal Production and Health 2014). According to the Central Bank report in 2015, total annual milk production from cattle and buffalo in Sri Lanka was 374.4 million litres, an increase of 12.1% over the previous year. Since domestic milk production is sufficient only to meet 40% of the national requirement, Rs. 31.842 million valued milk powder (81.759 MT) has been imported in 2015 which marked 21.7% increment compared to 2014 (Central Bank of Sri Lanka 2015). Consumers are also

taking a greater interest in the hygienic quality and safety of milk.

Milk quality is an important aspect that determines whether it is fit for human consumption or further processing. Physicochemical and microbiological quality parameters are used to determine its nutritional value and suitability for production of dairy products (Fox and MacSweeney 1998). Rapid tests at receiving points are normally used to decide whether to reject or accept the milk.

As raw milk is a rich source of nutrients, it provides favourable conditions for rapid growth and survival of several pathogenic microbes such as *Salmonellaspp*, *Campylobacter jejuni*, *Staphylococcus aureus*, pathogenic *Escherichia coli* strains, Hepatitis A while spoilage microorganisms include *Streptococcus lactis*, *Lactobacillus spp.* and *Acinetobacterjohnsoni*(Black 2004). These may derive from cow's udder and body or may enter from milk handling equipment, human handlers, air, soil, feed and pests such as flies and rodents (Hill 1952). The previous studies of milk quality from different areas of Sri Lanka revealed that microbiological quality is quite variable and often substandard (Deshapriya et al. 2004 and 2007; De Silva et al. 2016; Vairamuthuet al. 2010). The best way to ensure adequate microbiological quality and safety is by strict control and maintenance of hygiene at all stages of milk handling coupled with improved personal hygiene of milk handlers.

Kurunegala, is one of the important agricultural districts of Sri Lanka and is recognised for its coconut plantation, paddy cultivation and livestock industries. The dairy production in the Kurunegala district accounts for approximately 21% of the total domestic milk production (Department of Animal Production and Health 2014). According to the information given by the regional office of Department of Animal Production and Health – Pannala, Makandura livestock development instructor's (LDI) area has a significant number of small scale dairy farmers who produce around 292,000 L of milk per year.

The objective of this study was to assess the physicochemical and microbiological quality of raw milk, to identify the common hygienic practices which can directly affect the quality of raw milk received to milk collection centres from small scale dairy farmers in the Makandura area of Kurunagala district of Sri Lanka and to provide appropriate recommendations to improve milk quality via encouraging clean milk production.

## II. METHODOLOGY

Initially 75 raw milk samples were collected from dairy farmers supplying three milk collecting centres, Mahayawatta (MW), Makandura town area (MKT) and Pahala Makandura (PM) in Makandura area, during the period from June to August 2013. Duplicate samples were collected, one for microbiological studies and the other one for keeping quality, platform tests and physiochemical evaluation. Samples for microbiological studies were collected into labelled, sterilised glass bottles (50 mL) and other samples were collected into labelled, properly washed glass bottles (100 mL). Each raw milk supply container was thoroughly mixed to disperse the milk fat before taking samples. All the farmers were interviewed using a pretested questionnaire to assess their socio-economic background, hygiene and other management practices including feeding. Temperature and lactometer readings of each milk sample were measured directly at the sampling point using a thermometer and a lactometer, respectively. Samples for microbiological analysis were frozen until needed.

### *Platform tests*

Raw milk samples were screened using the Resazurin 10 minutes test (Davis 1994), the alcohol stability test using 68% (v/v) ethanol solution and a clot on boiling test (Roy and Sen 1991). Evaluation of organoleptic qualities (taste, appearance and odour) was done immediately after samples were delivered to the laboratory.

### *Adulteration tests*

This study focused on the presence of starch, salt and hydrogen peroxide, which are considered as common adulterants in Sri Lankan raw milk.

#### Detection of starch in milk

Around 10 mL of milk were pipetted into a test tube and 4-6 drops of 1% (w/v) iodine solution was added. The contents were mixed gently and after few minutes the colour at the bottom of the test tube was observed. The presence of dark blue or black particles indicated that starch has been added (Sacheti 1998).

#### Detection of salt in milk

One millilitre of milk was transferred to a clean test tube and two drops of 10% (w/v) potassium chromate solution and one

## III. RESULTS AND DISCUSSION

### *Socio economic background*

The dairy sub-sector in Sri Lanka mainly consists of small dairy farmers (Perera and Jayasuriya 2008). Only 40% of surveyed farmers in the Makandura area were involved in dairy production as their primary source of income, so dairy farming can be considered as an important secondary livelihood in this rural area. Similarly, 86% of these dairy farmers were categorized as small-scale producers, in which a farmer owned less than five cattle while the remaining 14% were identified as medium-scale farmers (owning 5-10 cattle).

Most of the farmers (63%) had more than two years' experience in dairy farming and 44% had participated in some kind of training session on dairy production. Background education was adequate, as 72% of dairy farmers had studied up to General Certificate of Education (GCE) Ordinary level and 16% had gone

millilitre of N/20 silver nitrate solution were added. Finally, sample was shaken well and colour change was observed (Sharma et al. 2012).

#### Detection of Hydrogen peroxide in milk

Around 10 mL of milk was measured to a test tube and 1 mL of 10% (w/v) KI solution was added. Then 10 mL of concentrated hydrochloric acid was added and the mixture held for three minutes in room temperature. A blue-black colour indicated the presence of peroxide in milk.

### *Physiochemical tests*

Specific gravity was determined by lactometer, correcting for the milk temperature. Fat was measured by the Gerber method (James 1961) while total solids (TS) and solids-not-fat (SNF) contents were calculated according to Spreer (1998). The pH value of milk samples was measured using a calibrated digital pH meter (OHAUS, Parsippany, USA).

### *Microbiological tests*

Samples for microbiological analysis were thawed out then serially diluted with peptone water (OXOID, Hampshire, England) to prepare a 10<sup>-1</sup>-10<sup>-5</sup> dilution series. For total plate counts appropriate dilutions (10<sup>-3</sup>, 10<sup>-4</sup>, and 10<sup>-5</sup>) were placed on plate count agar (HIMEDIA, Mumbai, India) using a pour plate method. Inoculated plates were incubated for 24 hours at 37°C. Developed colonies were counted using a manual colony counter and expressed in colony forming units per millilitre (CFU/mL). The two-tube most probable number (MPN) technique was performed to enumerate coliforms in milk, following a two-step incubation procedure. The presumptive test used was MACKONKY broth (HIMEDIA, Mumbai, India) and tubes were incubated for 48 hours at 37°C. Brilliant Green Bile broth (BGBB) (HIMEDIA, Mumbai, India) was used for the confirmation test for faecal coliforms, with tubes incubated at 44°C for 48 hours. Aseptic procedures were followed during all microbiological analyses.

### *Data handling*

Data obtained from the laboratory analyses and questionnaires were entered into MS EXCEL and analysed using Minitab 15.

on to GCE Advanced level. This supported the proposition by Vairamuthu et al. (2010) that farmers could be educated about recommended management practices, the importance of sustainable dairy farming and maintaining the required quality of raw milk

### *Dairy management system*

Extensive management was commonly practiced (96%) with only 4% of farmers adopting a semi-intensive system. Jersey and Jersey crosses accounted for the majority of the cattle population in this area. Most of the dairy farmers (78%) provided some form of housing for animals, mainly poor quality night sheds (92%). Few farmers used tie stalls (6%) or loose housing (2%). Free or tethered grazing was practiced under the trees in coconut plantations. Most animals were fed with cut grasses, crop residues and agricultural byproducts. Few farmers practiced

feeding cut grasses during the night along with grazing in daytime and the majority of the animal diets were supplemented with commercial feed, broken rice, rice polish and other byproducts that were available in the village. Some farmers had started to develop improved grass beds with the support of the government extension service. Hand milking was predominant and farmers were reluctant to move to machine milking since it required high capital investment and technical skills(Vairamuthu et al. 2010)

*Hygienic practices*

Milk let down from a healthy cow’s udder is virtually free from microorganisms but is readily contaminated. So it is essential to follow hygienic management practices. It is widely accepted that milking, storing and transporting equipment, milking area, exterior of the cow’s udder and the milker are the most common routes of contamination (Pandey et al. 2014).

Table 1 gives a summary of the cleaning practices in areas covered by the three milk reception stations. Cleaning of milking equipment was widely practiced though methods of cleaning varied. Pandey et al. (2014) identified that application of appropriate disinfectants such as iodophores in cleaning milking equipment markedly reduced the bacterial counts but none of the farmers from these areas used disinfectants in cleaning milking utensils. Acceptable stainless steel containers were commonly used for milk transport (MW=81%, MKT=73%, PM=54%) while a considerable amount of glass (9%) and plastic bottles (28%) were also used in PM. Cleaning of plastic and glass bottles is difficult due to the narrow neck restricting access. Microorganisms can easily grow in moist milky residues in such bottles (Donkoret al. 2007; Kuma et al. 2015).

Cleaning the milking area was not popular in PM where milking was generally done outdoors in the shade of a tree. This practice was also widely followed in the other areas. Most of the farmers (92%) had no separate milking area and almost all farmers who reared animals in tie stall barns (6%) milked in the rearing area, which was cleaned several times per day, especially before milking.

Table 1. Use of different milking area and equipment cleaning regimes among farmers from MW, MKT

Parameter	Percentage (%)		
	MW (n=33)	MKT (n=22)	PM (n=20)
<b>Frequency of cleaning milking equipment</b>			
Several times	16	6	10
Only before milking	16	11	36
Before and after milking	68	83	50
Not at all	0	0	0
Some times	0	0	4
<b>Method of cleaning</b>			
With clean water and detergent/soap	30	49	6
Only with clean water	36	29	72
Only with poor quality water	16	10	16

water			
Hot water and steam	18	12	6

**Frequency of cleaning milk storage and transportation equipment**

Only before using	24	12	21
Before and after using	76	88	79
Not cleaning at all	0	0	0
Some times	0	0	0

**Method of cleaning**

With clean water and detergent/soap	74	70	49
Only with clean water	12	23	34
Only with poor quality water	2	2	9
Hot water and steam	12	5	8

**Frequency of cleaning milking area**

Several times	2	2	3
Only before milking	64	66	64
Before and after milking	2	30	15
Not cleaning at all	4	1	5.5
Some times	28	1	12.5

**Method of cleaning**

With clean water and detergent	9	10	14
Only with clean water	10	52	5
Only with poor quality water	10	21	28
Sweeping	46	13	20
Not at all	25	4	33

In MKT, 75% of the farmers used deep wells as the primary water source and no-one had access to chlorinated tap water. Around 22% of farmers used a nearby stream as their main water source for the dairy units. As an area with extensive paddy cultivation, those streams were irrigation canals for paddy fields and there was a high risk of contamination with agrochemical residues.

Regardless of the area a significant proportion of dairy farmers were not adapted to use the recommended hygienic practices during milking, e.g. wearing special clean clothing, separation of infected animals, following milking order, foremilk rejection and complete milking as indicated in Figure 1. Farmers from PM were reported to have less concern to use hygienic practices than farmers from the other two areas. Even though a considerable proportion of farmers from all three areas (MW=43%, MKT=51%, PM=29%) stated that they wear special clean clothing for milking, they don’t wear the gloves, boots and coats that were recommended to use.

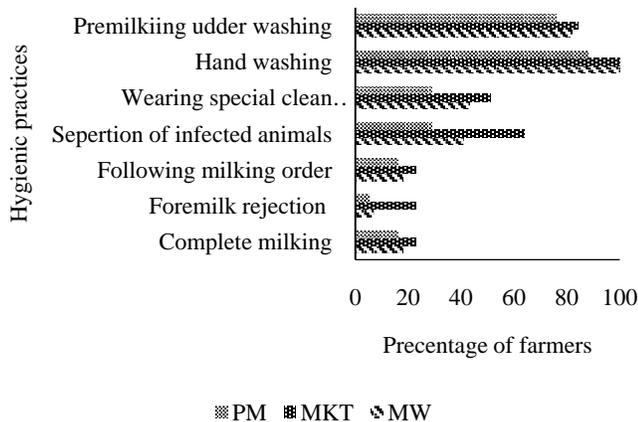


Fig 1. Use of preliminary hygienic measures during milking

Washing hands before milking was commonly practiced in all three areas but method and frequency differed. Accordingly, 24%, 6% and 6% of farmers from MW, MKT and PM stated that they washed their hands several times (inter-cow hand washing). It should be highlighted that 12% of farmers from PM did not wash their hands even before milking. In contrast, farmers from MKT and MW areas showed a positive concern towards hand washing as almost all washed their hands at least before milking. Most of the respondents (MW=82%, MKT=84%, PM=76%) implemented pre-milking udder washing with water, which was not followed by drying or wiping the udder. None of them used soap, detergent or any type of disinfectant for udder washing and this cannot be considered as sufficient cleaning Vairamuthuet al. 2010). Pre-milking udder preparation and teat disinfection play important roles in reducing bacterial counts in milk (Galton et al. 1984). Ineffective udder cleaning can be one of the important contributors to poor hygienic quality. Pre-milking udder washing was not practiced by the farmers who let the calf to suckle before milking since they believed that it helped to increase milk let-down and the teats get washed by the saliva of calf and there was no need to wash the udder before milking.

According to the farmers' responses, pest and disease problems that can affect the milk quality were not common in this area during the study period. However, none of the farmers used the strip cup test, the simplest method to detect early stages of clinical mastitis (Campbell and Marshall 2016). Some, 19% of the farmers surveyed had followed a milking order which was not based on the status of mastitis but milk production.

As with other studies (Millogo et al. 2008; Vairamuthu et al. 2010) none had adopted post milking teat dipping, the single most effective practice for reducing mastitis infections, as well as the total microbial load (Kamal and Bayoumi 2015).

#### Platform tests

Milk from PM was found to have the highest percentage of samples failing the COB, RTMT and alcohol tests, as shown in Figure 2. RTMT is mainly used to assess the freshness and hygienic quality of milk. In MKT, milk was only collected once a day but almost a quarter of the farmers (23%) milked twice daily. The evening milk was placed in a refrigerator overnight then mixed with the morning milk and taken to the milk

collecting centre. The farmers from MKT have been advised to deliver the morning and evening milk separately.

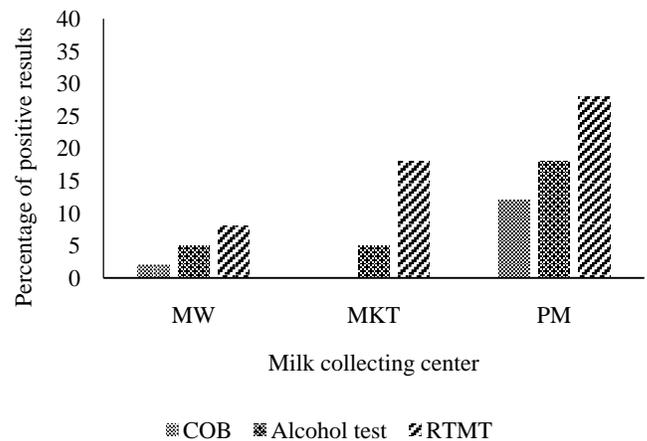


Fig 2. Percentage of milk samples from MW, MKT and PM showing failures for RTMT, COB and alcohol tests

Evaluation of taste, appearance and odour permits rapid segregation of poor quality milk at the milk receiving platforms. Accordingly, each and every milk container was tested in order to decide acceptance or rejection at all three milk collecting centres. Doubtful milk was kept and transported in a separate container to prevent contamination of other milk. As shown in Figure 3, PM had the highest percentage of sensory abnormalities. The presences of dirt particles, slightly sour taste and the smell of cow dung were noted as the most common abnormalities. This may be due to poor hygiene in milk handling plus a prolonged holding time prior to delivery, providing a favourable environment for microbial growth (Islam et al. 2013).

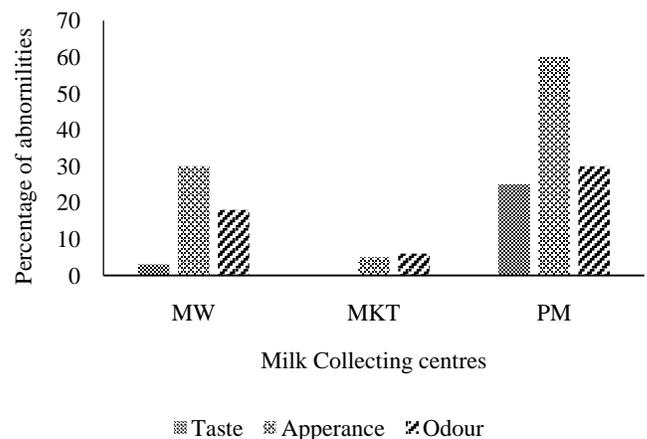


Fig 3. Percentage of samples from three areas showing sensory abnormalities (Taste, appearance and odour)

#### Adulteration

Raw milk adulteration is a serious and persistent issue in most developing countries (Abbas et al. 2013; Barham et al. 2014; Mahmoudi et al. 2015). In this survey however, not a single sample was positive for any of the adulterants. Similar results has also been found in other studies (Hossain and Dev 2013; Islam et al. 2013; De Silva et al. 2016).

*Physicochemical and microbiological quality*

There were no significant differences ( $p>0.05$ ) between the physicochemical quality parameters except for SG and SNF, as shown in Table 2. The mean fat and SNF percentages reported from all three milk collecting centres were within the acceptable range (Food Act no 26 1980). This may be achieved by quality breeding materials and proper nutrition management. The fat, SNF and TS percentages in the present study were higher than the percentages reported by Kittivachraet al. (2006) in Thailand but lower than the values reported by Dehinenet al. (2013) in Ethiopia.

Table 2. Physicochemical and microbiological quality of raw milks

Quality parameter	Milk collecting centre		
	MW Mean± SD (n = 33)	MKT Mean± SD (n = 22)	PM Mean± SD (n = 20)
<b>Physicochemical quality</b>			
Specific gravity	1.034±0.002 <sup>a</sup>	1.032±0.002 <sup>b</sup>	1.034±0.002 <sup>a</sup>
Total Solid (% w/w)	13.67 ± 1.0 <sup>a</sup>	13.3±1.3 <sup>a,b</sup>	13.7 ± 1.0 <sup>a</sup>
Fat (% w/w)	3.6 ± 0.6 <sup>a</sup>	3.8 ± 0.8 <sup>a</sup>	3.6 ± 0.6 <sup>a</sup>
Solid Non Fat (% w/w)	10.0 ± 0.5 <sup>a</sup>	9.5 ± 0.6 <sup>b</sup>	10.0 ± 0.5 <sup>a</sup>
pH	6.60±0.366 <sup>a</sup>	6.64±0.436 <sup>a</sup>	6.69±0.531 <sup>a</sup>
<b>Microbiological quality</b>			
Total Plate Count (x10 <sup>6</sup> cfu/mL)	1.2 ± 1.8 <sup>a</sup>	0.4 ± 0.4 <sup>b</sup>	5.4 ± 6.5 <sup>c</sup>
Total Coliform Count (MPN cfu/mL)	58 ± 43 <sup>a</sup>	29 ± 37 <sup>b</sup>	72 ± 34 <sup>c</sup>
Faecal Coliform Count (MPN cfu/mL)	36 ± 33 <sup>a</sup>	22 ± 31 <sup>b</sup>	51 ± 42 <sup>c</sup>

Means that do not share a same letter are significantly different ( $P>0.05$ ), n = sample size, SD = Standard deviation, MPN = Most probable number of bacteria

There were significant differences ( $p<0.05$ ) in microbiological quality parameters between the three milk collecting centres but all of them were below the expected standard of less than 30,000cfu/mL (Sri Lanka Standard Institute 1983). The mean TPC of Makandura (2.3 x 10<sup>6</sup>cfu/mL) was similar to that reported in the study in Jaffna, Sri Lanka, by Vairamuthuet al. (2010). The higher microbial counts may be due to a combination of poor hygiene, inadequate refrigeration and high ambient temperature. The results of the present study were in line with studies done in Sri Lanka (Deshapriya et al. 2004 and 2007) and in other tropical conditions (Lingathurai and Vellathurai 2010; Yuen et al. 2012).

IV. CONCLUSION

Regardless of the differences among the study sites, all showed poor microbial quality when compared to the established national and international standards for raw milk quality. This could be attributed to the cumulative results of inefficient

cleaning and disinfection coupled with poor concern and negligence of farmers towards appropriate hygienic practices. Training programmes on hygienic management and raising awareness of the importance of disease control may contribute to improvements but do not provide the necessary incentive. Currently in Sri Lanka, the major pricing elements are based on specific gravity and milk solids, whereas most of the developed countries follow a milk grading scheme that includes microbiological quality along with other physicochemical parameters to determine the economic value of milk. These more comprehensive payment schemes will be effective in motivating the Sri Lankan farmers to produce better quality milk.

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# Ethnic Unrest in Bodoland and Electoral Politics at Play

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**Abstract-** The aspiration and cultural dominance of one ethnic group to carve out an exclusive territorial and political space based on being indigenous to the land excluding the other community as the 'other' or 'outsider' who has historically been part of the same territorial and political space has resulted in creating strife in the society. The Bodo- non Bodos conflict in Bodo Territorial Autonomous District (BTAD) area has been marked by separatist insurgencies and violence which could be seen as a manifestation of preserving a distinct identity of being indigenous to the area. The policy framework by the government of India has further aggravated the conflict scenario in the region. The construction of the 'us' and 'them' and interplay of politics have led to fragmentation of the political system along ethnic lines. Violence is a manifestation of secessionist tendencies related to conflict in the region.

**Index Terms-** indigenous, ethnic, territorial, Bodoland

## I. INTRODUCTION

In the post-independence era, there developed a growing ethnic unrest with the ever-increasing flow of immigration into North-east region particularly Assam from the neighboring country of Bangladesh. The growing ethnic unrest owing to the threat of demographic and cultural invasion caused by large scale immigration from Bangladesh ultimately led to the outbreak of the famous Assam Movement.<sup>1</sup> Identity assertion and ethnic conflict is a widely debated issue in the political and academic discourse in Assam today. The region has been witnessing conflicts arising out of the aspiration for a separate and distinct ethnic identity among various groups in the multi-ethnic fabric. It also appears to be at the center stage of Assam politics. Competing claims over resources and creation of an exclusive ethnic homeland intertwined in politics of the region have been marked with contests over the ethnic 'self' and the 'other' construction. Often the migrant outsiders who have settled in the area and have been sharing the same political space are delineated as the 'other' and different from the indigenous 'us'. The politicization of the construction of the indigenous 'us' and delineation of the migrant as the 'other' have given rise to a political culture of violent separatism. The pervasiveness of the

<sup>1</sup>The Assam Movement is popularly known as the Assam Agitation or Asom Andolon that continued from 1979 to 1985 against government. The movement was ostensibly an upsurge of the "people of Assam" against the influx of large scale immigration from erstwhile Bangladesh. For more details see Hussain, Monirul., 1993. *The Assam Movement: Class, Ideology and Identity*, Manak Publications, Delhi p.27

unrest in the region can be attributed to the trend among the ethnic communities to claim separate statehood corresponding to the search for an exclusive homeland compounded by territorial claims and often marked by violence. As a result, the region is often viewed as precarious and unstable. An ordeal of the trend could be seen among the National Democratic Front of Bodoland (NDFB)<sup>2</sup> demanding a separate state from Assam. The electoral campaign in this constituency revolves around the contentious issue of a separate state for the Bodos. To achieve this end, the militant outfit indulged in violence and attacked the Adivasis, Bengali and other communities sharing the same territory with the indigenous Bodos. Out of this mayhem the Adivasis, soon set up their own militant group the Adivasi Cobra Militants of Assam (ACMA) against the Bodo sponsored violence. Another Bodo group, Bodoland Liberation Tigers Force (BLTF) was also formed to fight for a separate Bodo state within the Indian Union.<sup>3</sup>

## II. ASSAMESE NATIONAL ASPIRATION AND SECESSIONISM

The historic Assam Movement was an upsurge of the indigenous Assamese against the enfranchisement of, who they believe were, illegal immigrants from the neighbouring areas of Bangladesh post-independence. The agitators addressed appealed to the sentiments of the indigenous Assamese fold calling as an invasion and encroachment of foreigners or illegal migrants in their land. They called it as the last struggle for survival against the cultural, demographic and political transformation of Assam by the illegal immigrants.<sup>4</sup> The perceived threat of being reduced into minorities on their own land due to the onslaught of the migration generated the fervor of protesting against such encroachment. The culmination of such dissidence was expressed in the form of the famous Assam movement of the 1980's. The movement gained unprecedented support across the region. The movement which was initiated to safeguard the interest of the indigenous Assamese was soon surfaced with tensions with the signing of the Assam Accord in 1985 between the Government

<sup>2</sup>An outfit named Bodo Security Force (BdSF), under the leadership of Ranjan Daimary, was formed on October 3, 1986 to take up the cause of separate sovereign state of Bodoland. On November 25, 1994, the BdSF rechristened itself as the National Democratic Front of Bodoland (NDFB).

<sup>3</sup>Misra, Udayon, 2001. 'The Transformation of Assamese Identity', *North East India History Association*, Shillong., p.25

<sup>4</sup>Hazarika, Sanjoy., 1994. *Strangers in the Mist: Tales of War and Peace from India's Northeast*, Viking New Delhi p.148

of India and leaders of the movement.<sup>5</sup>There was growing apprehension for a hegemonic distinct ethnic Assamese identity being created with the signing of the Accord in the region. This irked the Bodos community who participated in the movement alongside the Assamese people in their struggle against the illegal invasion from Bangladesh. This has found expression in the fragmentation of the movement along ethnic lines and confrontations and violence.

The Bodos were apprehensive and suspicious of the cultural dominance and assimilation into the Assamese fold losing their distinct cultural identity and heritage with the inclusion of Clause 6 of the Assam Accord<sup>6</sup> which gave legitimacy of the imposition of Assamese language and culture upon the Bodo people and other ethnic communities of Assam. The provisions implicit in the Assam Accord constructed an exclusionist ethnic Assamese identity which alarmed the other ethnic minorities and encouraged them to construct their identities to claim politico-territorial autonomy and seek political legitimacy in their respective traditional homelands. The discursive 'singular indigenous Assamese identity' adopted by the ethnic Assamese paved the way for articulating the notion of indigeneity, which consequently became too sharp for an exclusive identity politics in Assam. The unassimilated linguistic minorities perceived the feeling of being marginalized and dominated by the growing Assamese nationalism under the political arrangements. This dissatisfaction continued to simmer in the region of Assam particularly among the Bodo tribes residing in western part of Assam. It also legitimized the creation of more radical armed groups with more stringent demands for self-determination. The unarmed peaceful movement soon turned into an armed national liberation struggle under the aegis of the United Liberation Front of Assam (ULFA) a banned militant outfit in contemporary Assam.

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<sup>5</sup>Baruah, Sanjib, 2003. 'Citizens and Denizens: Ethnicity, Homelands, and the Crisis of Displacement in Northeast India,' *Journal of Refugee Studies*, Vol. 16 No.1. p.51

<sup>6</sup>The Assam Accord (1985) was a Memorandum of Settlement signed between representatives of the Government of India and the leaders of the Assam agitation in New Delhi on August 15, 1985. The accord brought an end to the Assam agitation and paved the way for the leaders of the agitation to form a political party and form a government in Assam soon after. The Assam Accord was a tripartite agreement between AASU, the Government of Assam and the Government of India. After much debate and negotiations, AASU retracted from its earlier position of deporting all migrants who came after 1951 and agreed to recognize 25 March, 1971 as the cutoff date to determine foreign infiltrators in Assam. Clause 6 of Assam Accord states for constitutional, legislative and administrative safeguards, as may be appropriate shall be provided to protect, preserve and promote social, linguistic identity and heritage of Assamese people. Clause 10 provides that it shall be ensured that relevant laws and prevention of encroachment of government lands in tribal belts and blocks are strictly enforced and unauthorized encroachers evicted as laid down in such laws. See details ibid. p.134

### III. ULFA AND MILITANT NATIONALISM

At that juncture, the Assam agitation spearheaded by the All Assam Students Union (AASU) met with initial success catching the imagination of the Assamese public. However, the 1983 elections to the State Legislative Assembly and the widespread violence associated with the electoral process<sup>7</sup> was met with resistance by the people of the State. The perceived feeling of being alienated when the state engulfed in the problems of influx looked upon the Centre was guided by electoral gains conducted the parliamentary elections consolidated into full blown secessionism through petty violence. Such policies and attitude by the government led to a radicalization of Assamese sub nationalism, giving it a separatist turn. It was at this juncture that the newfound secessionism found expression in to a well organised outfit the United Liberation Front of Assam a strong revolutionary political organisation, who declared its aim to create an independent, Socialistic Assam exploitation-free, classless, healthy, progressive, with disparity' and free from Delhi's colonial occupation and exploitation.<sup>8</sup> Though the ULFA was founded on April 7, 1979, it came to be noticed as a nascent-armed organisation only in late 1983. The ULFA soon lost its popularity among the people of Assam owing to its obsession with sovereignty and fight against Delhi. It failed to address the everyday problems faced by the people of Assam like corruption and migration from the bordering areas.<sup>9</sup>

Most of the indigenous ethnic groups in Assam are now demanding a separate autonomous territory if not a separate state waging violence in the region and causing widespread displacement.<sup>10</sup> In the contemporary period the ULFA's secessionist rebellion have sprouted other rebel groups for the pursuance of secessionist and separate statehood in Assam. Against this backdrop of newly aroused tensions running along perceived ethnic lines the Bodo Liberation Tigers (BLT) took up arms to wage a bitter battle with the state and demand for separate state of Bodoland within the Union of Assam. It is argued that contentious politics is a part of the violence in Bodoland.<sup>11</sup> Drawing inspiration from its counterpart ULFA the BLT also adopted violent means in pursuance of their claim with serious implications.

### IV. THE BODOLAND MOVEMENT AND ETHNIC UNREST IN THE REGION

Ethnic groups try to consolidate their identity due to the perceived fear of marginalization and discrimination and a threat

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<sup>7</sup>Maitra, K., 2001. '*The Noxious Web-Insurgency in the Northeast*', Kanishka Publishers, New Delhi

<sup>8</sup>Hazarika, Op. Cit. p. 168

<sup>9</sup>Mahanta, Nani Gopal., 2013. '*Confronting the State: ULFA's Quest for Sovereignty*', Sage Publications, New Delhi p.348

<sup>10</sup>Hussain, Monirul and Pradip Phanjoubam, 2007. '*A Status Report on Displacement in Assam and Manipur*', Mahanirban Calcutta Research Group, Kolkata

<sup>11</sup>Kundu, D.K. 2010. '*The State and the Bodo Movement in Assam*', APH Publishing Corporation, New Delhi

to their social, political and cultural existence by the majority and often in their search of identity and struggle to perceive as oneself as being different from the other often resorts to violence. The signing of the Assam Accord aroused suspicion and apprehensions when the interests of the Bodo community who has been sharing the same political space with the indigenous Assamese were not taken into account. The language policy and provisions of the Accord created a deep sense of alienation in relation to the Assamese society of which they had been considered to be a peripheral part. This was reflected in the violent clashes between the Bodos and the Assamese in the late 1980's. The aspiration for autonomy soon turned into a demand for a separate state adopted by groups like the Bodo Security Force (BSF) later renamed as the National Democratic Front of Bodoland (NDFB), which demanded a separate Bodoland. In 1993 a memorandum of settlement was signed between the State government, ABSU and Central government to create the Bodoland Autonomous Council. The design was a failure and the militant outfit intensified its struggle. In 2003 after large scale of agitation second Bodo Accord was signed and B.T.A.D was created to subdue the rising violence in the region. The creation of the B.T.A.D curtailed the rights and privileges of the non-Bodos leading to greater insecurity amongst the non-Bodos. The Bodos framed their demand on their claim that the Bodos are the indigenous people of Assam. In Assam whenever a singular cleavage of language or 'indigeneity' mobilised, political competition has often spiralled into bloody riots. In constructing a single distinct indigenous identity, the Bodos ignored the specificities of smaller communities that existed in Bodoland. The antagonism perceived in this context can be attributed to the outbreak of irreconcilable conflicts between the Bodos, Adivasis, Koch-Rajbanshi's over the issue of the formation of the Bodo Territorial Council (BTC) under the revised 6th Schedule of the Indian Constitution.

#### V. ELECTORAL POLITICS AND UNREST IN BODOLAND

In course of time the aspiration for separate statehood in Bodoland has percolated into the realm of politics. In the political parlance, the fear of loss of identity by smaller ethnic groups and aspiration for a distinct identity and preserving and protecting it against the politics of homogenization is one of the most significant aspects of ethnic politics in the region. Often the state adopts various mechanisms to articulate the interest of communities. The Sixth Schedule was a significant part of the institutional arrangement to foster a privileged position for minorities or tribal communities and to give them effective responsibility in matters of governance concerning them and instill a sense of belonging and participation. It was primarily intended to cater to the aspirations of minority groups and to protect them from the threat of marginalization, domination and homogenization by the majority. It has been used not only as a mechanism to accommodate the claims of territorially-organized ethno-linguistic groups but simultaneously as an attempt in shaping the public space for the expression and maintenance of identity of the territorially dispersed minority groups and communities. However, this arrangement of accommodating the articulated interest of one ethnic group led to exclusion and alienation of the others. It is pertinent to examine the contentious

politics at play in this regard. Bodoland has been on a theatre of statehood agitation since the mid-1980s. Numerous political tactics have been utilised by the successive agitators to recognize the Bodos as the indigenous ethnic group. The institutional arrangement prevalent in the region has made these autonomous councils grounds for contesting multiple claims for an ethnic homeland where ethnic groups compete for space, resources and legitimacy within the boundaries of these arrangements.<sup>12</sup>

The Bodo movement initially emerged in a peaceful manner within the Constitutional framework. In course of time, it turned violent when the state used repressive machinery and resorted to violent methods to suppress the ethnic mobilization taking place by invoking force. The territorial demarcation of the BAC failed and became a bone of contention between the Assam government and ABSU leadership in turn led to the collapse of BAC. A shift was noticeable in the nature of politics in Bodoland in the context of the collapse of the Bodo Accord. As regards to violence, instances such as of the Adivasi Cobra Militants and the Bengal Liberation Tigers attacking several Bodo villages proved that it was violence and counterviolence, resulting in a chain of violence, with each party trying to assert its own point. It was alleged that violent conflicts between the Bodos and non-Bodos was a political design of the state and some underlying force whose motive was to disrupt the Bodoland movement by taking advantage of the already divided Bodo society and the opposition to the formation of Bodoland by various forces.<sup>13</sup> Though the BAC failed it bolstered the imagination of a territorially contiguous ethnic homeland among the Bodos that would include and protect all the indigenous Bodos from the outside intruders. The harbouring idea of an all-Bodo homeland escalated into large-scale mass violence against the non-Bodos within the boundaries of the imagined homeland of the Bodos.

It was quite apparent that the decision of the state to open a peaceful political engagement with the secessionist movement triggered a serious conflict. After the collapse of BAC, the Bodoland Territorial Council was created by a tripartite agreement between Bodo Liberation Tigers (BLT which was in ceasefire since 2000), the Assam and the Central government under the protection of the Sixth Schedule of the Indian Constitution with definite territorial demarcation.<sup>14</sup> With the signing of the Memorandum of Settlement (Mos) the Bodo Territorial Council (BTC) was formed in 2003 and the political autonomy of the Bodos was greatly enhanced on the one hand, and was considerably contained on the other. The creation of the BTC met various formidable challenges, including that of the NDFB which was committed to a sovereign Bodoland. Besides

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<sup>12</sup>Barbora, Sanjay .2008. 'Autonomous Districts and/or Ethnic Homelands: An Ethnographic Account of the Genesis of Political Violence in Assam (North-East India) Against the Normative Frame of the Indian Constitution,' *International Journal on Minority and Group Rights* 15, p.313-334

<sup>13</sup>Kolas, Ashild. 2017. 'Framing the tribal: ethnic violence in Northeast India,' *Asian Ethnicity*, Vol. 18, No. 1, p. 22-37.

<sup>14</sup>Misra, Udayon. 2012. 'Bodoland: The Burden of History', *Economic and Political Weekly*, XLVII (37), p. 36-42.

internal opposition from within the Bodo community, the creation of the BTC also faced opposition from the non-Bodo community who was opposed to any form of greater political autonomy for the Bodos. Subsequently, the BTC comprised of the four districts of Kokrajhar, Baksa, Chirang, and Udalgur, otherwise known as the Bodoland Territorial Area Districts (BTAD). The discontent and uncertainties in the BTAD and perceived threat of Bodo militant groups to oust them from the Bodo dominated areas led the non-Bodo communities such as the Santhals, Koch Rajbongshis to form their own militant outfits with the motive of countering the depredations committed by the Bodo militants. The Santhals formed the Bisa Commando Force (BCF) and Adivasi Cobra Militant Force (ACMF), the Koch Rajbongshis formed the Kamatapur Liberation Organisation (KLO).

## VI. THE CHANGED POLITICAL SCENARIO IN BODOLAND

The political scenario in the BTAD exhibited the polarization of the existing ethnic cleavage between Bodos and non-Bodos in the region. The power struggle and fratricidal nature of Bodo politics fostered factionalism in the electoral politics of Bodoland. After the autonomous council was formed in 2003, ex-militants formed a political party, the Bodo People's Front, which further splintered, into Bodo Progressive People's Front.<sup>15</sup> While the BPF won the Lok Sabha election in 2009, in 2008, the BTAD areas witnessed a fresh round of fratricidal killings. In the subsequent Assembly elections of 2006 and 2011 a split occurred between the BPF and BPPF guided by factional interests to win over the community with each fraction trying to outdo the other in clamouring for separate statehood and even a sovereign country for the Bodos.<sup>16</sup> This bickering spiralled into several incidents of violence against its own community as well as the other communities who were often labelled as the other outsider.

The anxieties and perceived fear of identity loss, language and cultural hegemony have dominated the polemics of Bodoland politics. The BTC have failed to prevent the recurrence of violence and damage to lives and property of Bodos and non-Bodo populations living in Bodoland. Sporadic incidents of violence following between Bodos and Muslims in 1993, 2008, 2012 and 2014, resulting in hundreds of deaths and thousands of displacements and the Adivasi and Bodo conflicts in 1996, 1998 and December 2014<sup>17</sup> has been preceded by politicization and fragmentation of the population along ethnic lines. The politics of indigeneity in this context has fostered the creation of separate

collective identities by the non-Bodo groups who are victims of marginalization, violence and restricted mobility in the region. The elections campaigns in Bodoland has somewhat become a quest to preserve one's cultural identity and protest against the Bodo hegemony in the region. In the wake of aspiration for creation of a separate homeland carving out the communities sharing the same territory, peace in Bodoland continues to be fragile. The formation of the Sanmilita Janagosthiya Aikya Mancha (SJAM) an umbrella organisation of 23 non-Bodo ethnic and linguistic communities residing in Bodoland in 2014 Lok Sabha polls largely to protect the rights of the non-Bodos in the BTAD region and the win of the Naba (Hira) Kumar Sarania, Former commander of the elite strike force 709 battalion of the United Liberation Front of Assam, in the last parliamentary polls from Kokrajhar depicts a changed political climate in the complex politics of Bodoland. The history of ethno political subjugation is seemed to have been collectively challenged by formation of this alliance. The violence that broke out post elections reflected the retaliatory attitude and contention of the Bodos against the non-Bodos. The violence also displaced many Muslim population who were condemned for not voting in favour of the Bodo candidate in the elections.<sup>18</sup>

The violence ethnic clashes between the ethnic communities prove that violence inflicted by one group on the other is met with counter violence resulting in a chain of violence with each party trying to assert its claim. The violence that has been taking place in Bodoland had rendered thousands homeless and caused wide spread damage to property and environment.<sup>19</sup> The recent incidents of riots in 2012 -2013 have once again highlighted the volatility of violence and ethnic unrest in Bodoland and sporadic antagonism of the other non-Bodo communities in the region.<sup>20</sup> It has also rejuvenated the debate on influx of migrants and citizenship in Assam politics.

In the aspiration to carve out a separate state each ethnic group has carried out armed attacks and counter-attacks against each other giving rise to conflict situations not only in the Bodo areas but also created a volatile situation in the whole of Assam constructing the indigenous 'us' and the outsider 'other'. The existence of militant outfits clamoring the cause of separate Bodoland working in nexus with the political groups have serious ramifications in the politics of Assam. Lack of cohesiveness among the political counterparts and failure of peace initiatives have plunged the region into conflicts and violence largely affecting the lives of common people of the region from all quarters. The creation of Telengana on July 30, 2013 has also intensified the issue of separate statehood in Bodoland

<sup>15</sup> Mahanta, Nani Gopal, 2013. 'Politics of Space and Violence in Bodoland,' *Economic and Political Weekly*, Vol. 48, Issue No. 23, p.

<sup>16</sup> Goswami, Sandhya. 2012. 'Changing trends of electoral politics, Assam: Unstable Peace,' *Seminar*, December. 640

<sup>17</sup> Prabhakar, M.S. 2003. 'Territories of Fear', *Frontline*, Vol. 20, no. 24, <http://www.frontline.in/static/html/fl2024/stories/20031205003103900.htm> (last accessed on 7<sup>th</sup> May, 2017)

<sup>18</sup> For more information about the violence, see 'Report of Fact-Finding Team from Centre for Policy Analysis, New Delhi' [http://www.iosworld.org/download/fact-%20finding\\_Baska\\_Assam.pdf](http://www.iosworld.org/download/fact-%20finding_Baska_Assam.pdf), (last accessed 2<sup>nd</sup> June, 2017)

<sup>19</sup> Bharali, Gita, 2004. 'Labour Unrest and Social Insecurity of Plantation Workers: A Case Study,' North Eastern Social Research Centre, Guwahati

<sup>20</sup> Dutta, Anwesa, 2016. 'The Politics of Complexity in Bodoland: The Interplay of Contentious Politics, the Production of Collective Identities and Elections in Assam, South Asia,' *Journal of South Asian Studies*, 39:2, p.478-493,

## VII. CONCLUSION

Uneven competition and perceived feeling of marginalization and the institutional mechanism of dealing with various autonomy demands have eventually intensified ethnic conflict massively disturbing the tranquility of the area. The demand for separate state of Bodoland based on ethnic recognition and political autonomy has shaped the politics of resistance and retribution in the region and struggle for political and economic power. The institutional means of accommodation such as granting autonomy to particular ethnic groups in North eastern region have yielded exclusionary tendencies created by both the state and the dominant community. In Bodoland several communities concern for the various perceived threats to their distinct ethnic identities, their anxiety for preservation of culture and language, and aspiration for ethnic homelands is often backed by the ethnic militia. The mobilisation of single axis of identity by the political set up and ethnicization of the party system has led to widespread violence. Riots and violence causing displacement and loss of life and property is extricably linked to the fratricidal politics of Bodoland. The need of the hour is to address the Bodo insurgency in Assam above opportunistic politics at play with due consideration to look into endless possibilities for bringing peace and tranquility in the state. The antagonism that has developed between the Bodos and non-Bodos needs to be resolved in an atmosphere of good faith and adopt concrete programs for redressing their dissatisfaction.

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# Formulation of artificial feeds for Indian Carp (*Catla catla*) fry using aquatic plants (*Ipomea aquatica* and *Hydrilla verticillata*)

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**Abstract-** There is no recommended low cost feed available from fry to fingerling stage of Indian carps in Sri Lanka. Hence, this study was aimed on utilizing locally available aquatic plants *Ipomea aquatica* and *Hydrilla verticillata* and discarded dry fishmeal in feeds of *Catla catla* fry to cut down the feed cost. The experiment was conducted in a complete randomized design. Three experimental feeds were formulated using different protein sources while keeping other ingredients constant (T1= 1:1 discarded dried fish meal: *Hydrilla verticillata*, T2= 1:1 discarded dried fish meal: *Ipomea aquatica*, T3 = discarded dried fishmeal) and a commercial feed was used as the control. *Catla catla* fry were stocked at a density of 75 fry per m<sup>2</sup> in 12 pond units. Fry were fed at the rate of 5% of the body weight. Growth and water quality parameters were measured weekly and feeding behavior was also observed. Data were analyzed using the one way Analysis of Variance (ANOVA) procedure in SAS. All treatment feeds were accepted by fish and palatability was same. *Hydrilla verticillata* incorporated feed was moderately stable in water whereas, T2, T3 and commercial feeds were comparatively stable. Total body length, wet body weight and specific growth rate (SGR) of the fry were significantly different ( $p < 0.05$ ) and the highest SGR were recorded in fry fed with T3. Fish showed isometric growth against all the feeds. The highest FCR was recorded with the fry fed with aquatic plants incorporated feed. Survival rate of fry and water quality parameters were not significantly affected by the treatment feeds ( $p > 0.05$ ). The lowest feed costs were recorded in T1 and T2 feeds and it was 60% less compared to commercial feed. In conclusion, there is a potential benefits of using discarded dried fishmeal, *Ipomea aquatica* and *Hydrilla verticillata* in aqua feeds for fry stage of *Catla catla*.

**Index Terms-** Aqua feed, *Catla catla*, Discarded dried fishmeal, *Hydrilla verticillata*, *Ipomea aquatica*

## I. INTRODUCTION

In Sri Lanka, inland fisheries sector contributes around 0.2% to the Gross Domestic Production (GDP), showing 70% growth of inland fishing contribution. Further, it accounts for about 20% of the total fish production of the country. The sector provides direct and indirect employments to considerable number of people. Moreover, fish products are an important source of

animal protein and around 70% of Sri Lankans consume fish and related products to fulfill their protein requirement [1].

Inland fish production mainly consists of capture based fishing activities and is mainly dependent on exotic species such as Tilapia spp, Indian carps and Chinese carps [2]. However, sustainability of aquaculture production depends on proper feeding and farm management [3]. Feeding of fish has become one of the critical management practices today, as it occupies 50-60% from the total cost of production. Therefore, it is important to produce low cost feeds for small scale farmers in order to reduce the cost of farm operation. In Sri Lanka, there is no recommended low cost feed available from fry to fingerling stage of Indian carps. Some farmers have been using their own ingredients in formulating fish feed, without considering availability of nutrient in the raw materials and the nutritional requirement of the fish. Thus, those feeds do not contain required amount of nutrients and it is impossible to achieve higher growth rate of fry under local conditions.

Of the feed ingredients, protein source is one of the expensive ingredients in the formulated feed. Fish meal is still an essential ingredient in the diets and it is also an expensive feed ingredient compared to other protein sources and thus represents a significant cost element in feed and production cost. This has necessitated the search of alternative sources available locally in the country. In this context, use of certain potential aquatic weeds offer excellent scope as the nutrient laden materials are naturally grown in the entire country without much agronomic care. Many aquatic plants such as *Eichornia crassipis*, *Hydrilla verticillata*, *Salvinia aculata*, *Ipomea aquatica*, *Pistia* spp. etc. contain fairly high amount of protein. Aquatic plants also contain high amount of vitamin E, vitamin C and mineral elements required for normal growth and development of fish [4]. *Ipomea aquatica* and *Hydrilla verticillata* are currently used in many South East Asian countries as the alternative feed ingredients. Those two aquatic plants have fairly high feeding value, with moderately high protein content [5]. The intensive growth of aquatic weeds in culture ponds and reservoirs are one of the prevailing problems in fish production. If aquatic weeds are used effectively in feed formulation, it will be a solution for management of aquatic weeds. Thus, present study was undertaken to formulate cost effective feeds for the fry to fingerling stage of *Catla catla*, using locally available feed ingredients including aquatic plants under a semi intensive culture system.

## II. METHODOLOGY

### Location

The study was conducted at the National Aquaculture Development Center, Ibbankaduwa, Dambulla, which is located in DL<sub>1</sub> agro ecological zone.

### Preparation of Mud Ponds

Four rectangular mud ponds, each with a size of 20 x 20 x 1.5 m<sup>3</sup> were used for the experiment. Each pond was divided into three sub units with a size of 10.5 x 20 m<sup>2</sup> using two fry nets (mesh size = 4 mm) and separated units were considered as the replicates. Pond preparation was done, two weeks prior to the stocking of fingerlings and followed disinfection, fertilization and water management.

Calcium hypochlorite (at a rate of 30 g/m<sup>2</sup>) was used as the disinfecting agent and was applied manually on the floor of water drained dry ponds, which remained for about two weeks. Cow dung culture prepared using 500 g/m<sup>2</sup> fresh cow dung, 4 g/m<sup>2</sup> urea and 4 g/m<sup>2</sup> triple super phosphate (TSP), was used to fertilize the ponds. In preparation, cow dung was thoroughly mixed with water in an aluminum tough with a volume of 100 m<sup>3</sup> to make a fine textured mixture. Then, dissolved urea and TSP solution were added to the culture and mixed well. The final mixture was allowed to settle for four days and equal amount of prepared mixtures were added manually to each pond unit. Each pond was filled up to 0.3 m height with water from Ibbankaduwa tank after fertilization. After seven days of fertilization, water level was increased up to 1.22 m height and a secchi disk reading was maintained around 30 cm. When the secchi disk reading was lower than the 30 cm, water was flushed out through outlet and new water was pumped to the pond. Cow dung culture (250

g/m<sup>2</sup> cow dung, 2 g/m<sup>2</sup> urea and 2 g/m<sup>2</sup> TSP) was mixed the water.

### Fish Seed and Stocking

Fourteen days old, *Catla catla* fry (mean body length = 2.2 cm and mean body weight = 0.1 g) were used as the fish seed (n = 15) in each replicate. After one week of fertilization of ponds, the fry were stocked at a stocking density of 75 fry per m<sup>2</sup> in each pond unit. Required number of fry for stocking were measured using counting cups.

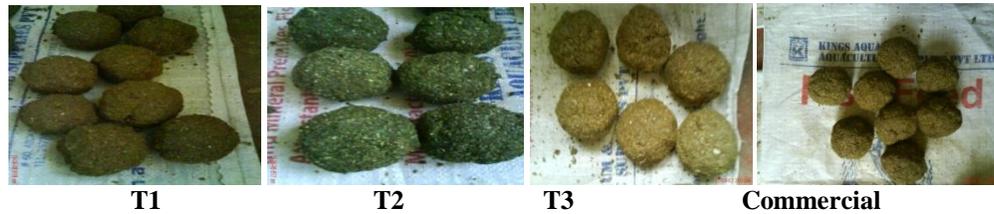
### Experimental Feeds

Three experimental feeds (T1, T2, T3) were formulated by trial and error method considering protein, essential fatty acids, fiber and energy requirements of the fish (Table 01). Commercial feed (a tropical commercial fish feed; No 00) was used as the control treatment. Discarded dried fish meal, *Ipomea aquatica*, *Hydrilla verticillata* were cut into small pieces and allowed separately for sun drying, to reduce the moisture content approximately up to 20% for two days. Soya bean was dried under the sun for 48 hrs. in order to reduce the trypsin inhibitors. Coconut poonac was also sun dried for about 4 hrs. After drying, ingredients were grounded separately to make a powder, and sieved using a sieve (mesh size = 1 mm). Finally, ground samples were packed separately in polythene bags until feed preparation.

The required amounts of feed ingredients for the experimental diets T1, T2 and T3 were measured and macro ingredients were mixed thoroughly. Then, vitamin, mineral pre-mixture and coconut oil were added gradually to the dry ingredients mixture and mixed thoroughly. Wheat flour was used as the binding agent and warm water (60 C<sup>0</sup>) was added into the mixture and feed balls were prepared manually (Plate 01).

**Table 01: Composition of treatment diets**

Ingredients (%)	Treatment feeds		
	T1	T2	T3
Discarded dried fish meal	30	30	60
<i>Ipomea aquatica</i> meal	30	-	-
<i>Hydrilla verticillata</i> meal	-	30	-
Soya bean	13	13	13
Rice bran	12	12	12
Coconut poonac	8	8	8
Wheat flour	5	5	5
Coconut oil	1	1	1
Vitamin pre mix	0.5	0.5	0.5
Mineral pre mix	0.5	0.5	0.5



**Plate 01: Different types of experimental feeds**

### Feeding

Feeding trays (polythene sheets attached to a polyvinyl chloride pipe frames) with a size of 1 m x 1 m<sup>2</sup> were used to feed the fry. Two feeding trays were placed at the two corners of each pond unit. Four wooden poles were used to place the feeding tray inside the water and the four corners of the feeding tray were bonded to the wooden poles (Plate 02).



**Plate 02: Placement of feeding tray**

The required feed quantity for subsequent period was calculated after measuring the total wet body weight and fry were fed at the rate of 5% of the body weight (per day), three times at 8.00 a.m., 12.00 noon and 5.00 p.m.

### Data Collection and Calculations

The feeding behavior of fish, palatability, acceptance and stability of feeds in water were determined by daily observations. The nutritional quality of all experimental feeds were determined by proximate analysis following the standard [AOAC \[6\]](#) procedure. Total body length and wet body weight of the fry were measured using a ruler and electronic analytical balance respectively in weekly intervals, taking random sample (n=15) from each replicate. The specific growth rate (SGR) was calculated at the end of the each week using following equation.

$$SGR = \frac{[\ln(\text{mean final wet weight}) - \ln(\text{mean initial wet weight})]}{\text{Number of days}} \times 100$$

Feed conversion ratio (FCR) was calculated by standard equation at the end of the experiment.

Four water samples from each replicate were collected at around 5.00 am - 7.00 am to measure the water quality parameters weekly. Temperature was measured using a thermometer at about 30 cm depth of water and pH, dissolved

oxygen (DO), hardness, NH<sub>3</sub> concentration were measured using a Hach kit (model FF-1A). Light penetration was measured using a secchi disc. Water sample was collected from each replicate, close to each feeding trays in order to measure the NH<sub>3</sub> concentration. Cost of feed ingredients were noted and cost analyses were done for each feed to find out the least cost aqua feed for *Catla catla* fry.

### Fish Harvesting

At the end of the experiment, the total fish of each replicate was harvested separately using fry harvesting net with mesh size of 2 mm and counting was done using a counting cup. The survival rate was calculated using following equation.

$$\text{Survival rate (\%)} = \frac{\text{Number of fish survived}}{\text{Number of fish stocked}} \times 100$$

### Data Analysis

Continues variables were analyzed using Analysis of Variance (ANOVA) procedure of Statistical Software for Data Analysis (SAS, ver. 9.0) to evaluate the best incorporation level of feed. Mean separation was done by Tukey's Studentized Range Test (TSRT) and statistical significance was declared at  $p < 0.05$ .

The following experimental model was applied to analyze the data.

$$X_{ij} = \mu + T_i + E_{ij}$$

where:

X<sub>ij</sub> = Any observation made in the experiment

M = Observed mean

T<sub>i</sub> = Effect of experimental diet (i = T1, T2, T3 and commercial feed)

E<sub>ij</sub> = Residual error

Relationship between body length and body weight were found by MINITAB computer software using following equation,

$$\ln w = b \ln l + \ln a$$

whereas,

w = weight in gram, l = length in centimeter, a and b = constants

## III. RESULTS AND DISCUSSION

### Proximate composition of Experimental Feeds

Crude protein content of the experimental feeds ranged from 27.5 - 42.0% while commercial feed had the highest crude protein content (Table 02). Crude fat and fiber content of feeds

were more or less similar and the highest gross energy was recorded in T2 feed where incorporation of 1:1 discarded dried fish meal and *Ipomea aquatica*. This may be due to the presence of high amount of carbohydrate (38.6%) in *Ipomea aquatica* [5].

Gross energy content of other two test diets and control also changed within a narrow range.

**Table 02: Nutrient composition of formulated feeds**

Proximate composition	Treatment feeds			
	T1	T2	T3	Commercial*
Moisture, %	8.1	8.9	9.1	-
Ash, %	25.6	17.6	20.5	12.0
Crud protein, %	27.5	30.4	36.3	42.0
Crude fat, %	9.1	9.6	9.9	10.0
Crude fiber, %	5.9	6.6	4.6	4.0
Crude energy, Kcal/ kg	3289	3843	3473	3350

\*Values were provided by the manufacturer

Ash content of the test feeds was much higher than the commercial feed and the highest ash percentage was observed in T2 feed.

#### Quality of the Formulated Feeds

As the fry were not familiar with tray feeding, they did not accept the feeds at once. However, after 2 - 3 days later, they were familiar for tray feeding and observed that, they crowded around the trays while feeding. During the 1<sup>st</sup> week of the experiment, T1, T2 and T3 feeds were not readily accepted by fry. However, commercial feed was readily accepted as they were fed with commercial feed before the experimental period. However, after the 1<sup>st</sup> week, the fry soon became accustomed to the experimental feeds and observed that, they fed actively throughout the experimental period. The acceptance of feed depends upon variety of factors, such as availability, appearance, particle size and organoleptic properties relating to smell, taste and texture [7]. Commercial feed usually contains high quality fish meal and has a comparatively good smell, which attracts fry to the feed. This may be also a reason for readily acceptance of commercial feeds than other formulated feeds.

From the beginning of the experiment, commercial feed was highly palatable to young fish. Texture of commercial feed was soft than the other formulated feeds. Soft feed often proving to be more palatable to the fish [8, 9] and fish may be capable of handling larger feed particles when they are soft [10]. During the 1<sup>st</sup> week, palatability of T1, T2 and T3 feeds were moderate. However, after the 1<sup>st</sup> week, most of the fry readily fed on all other feeds as commercial feed. Palatability of T1, T2 and T3

feeds may be due to fish meal or other cumulative effect of combination of several feed ingredients. These results further confirmed that, the replacement of fish meal by 50% *Ipomea aquatica* or *Hydrilla verticillata* leaf meal did not affect the palatability of feeds.

T2, T3, and commercial feeds were highly stable in water, where the T1 feed was moderately stable. Jayaram and Shetty [11] indicated the fat content in feed is known to give the compactness for the feed by preventing the entry of water. The higher fat content of T2, T3 and commercial feeds may be the reason for the high stability in water.

#### Growth Parameters and Cost of Feeds

The wet body weights and length gained by fish were significantly different ( $p < 0.05$ ) among treatments (Table 03). At the end of the study period, mean wet body weight and length achieved by young fish varied between 2.70 g - 4.82 g and 5.77 - 6.68 cm respectively. The mean wet body weight and length were similar between the fry fed with T1 and T2 feeds and fry fed with T3 and commercial feed ( $p > 0.05$ ). However, body weight and length were significantly greater ( $p < 0.05$ ) in the fry fed with T3 and commercial feed compared to the feeds incorporated with aquatic plants. Degani, Ren-Zvi [12] established a positive relationship between growth rate and protein content of diet. The present study also showed a significantly higher growth with high protein levels in commercial and T3 feed than the low protein levels in T2 and T1.

**Table 03: Effect of treatment feeds on growth performances**

Variable	T1	T2	T3	Commercial	SE
<b>Wet body weight (g)</b>					
Day 0	0.1	0.1	0.1	0.1	0.01
Day 7	0.51 <sup>a</sup>	0.57 <sup>b</sup>	0.69 <sup>b</sup>	0.89 <sup>c</sup>	0.08
Day 14	0.70 <sup>a</sup>	0.80 <sup>a</sup>	1.58 <sup>b</sup>	1.33 <sup>b</sup>	0.22

Day 21	1.20 <sup>a</sup>	1.36 <sup>a</sup>	2.13 <sup>b</sup>	2.01 <sup>b</sup>	0.23
Day 28	2.70 <sup>a</sup>	2.94 <sup>a</sup>	4.82 <sup>b</sup>	4.22 <sup>b</sup>	0.50
<b>Total body length (cm)</b>					
Day 0	2.2	2.2	2.2	2.2	0.08
Day 7	3.60 <sup>a</sup>	3.73 <sup>a</sup>	4.01 <sup>b</sup>	4.08 <sup>b</sup>	0.11
Day 14	3.92 <sup>a</sup>	3.92 <sup>a</sup>	4.84 <sup>b</sup>	4.68 <sup>b</sup>	0.24
Day 21	4.70 <sup>a</sup>	4.76 <sup>a</sup>	5.37 <sup>b</sup>	5.23 <sup>b</sup>	0.17
Day 28	5.77 <sup>a</sup>	5.99 <sup>a</sup>	6.68 <sup>b</sup>	6.47 <sup>b</sup>	0.21
<b>SGR</b>	10.95 <sup>a</sup>	11.14 <sup>a</sup>	12.66 <sup>b</sup>	11.96 <sup>c</sup>	0.94
<b>FCR</b>	0.98 <sup>a</sup>	0.95 <sup>a</sup>	0.67 <sup>b</sup>	0.71 <sup>b</sup>	0.14
<b>Survival rate (%)</b>	73.73	74.12	75.12	75.34	4.15
<b>Feed cost (Rs.)*</b>	82.15	79.90	124.40	181.90	Total

a, b, c values with different superscripts within each row differ significantly  $p < 0.05$

\*In Sri Lankan Rupees and did not statistically analyzed.

This slight reduction of body weight and length gain of young fish fed with 42% protein level in commercial feed compared to T3 may due to exceeding of optimum protein requirement of fry of *Catla catla*. Kalla, Bhatnagar [4] indicated that, the optimum protein requirement of *Catla catla* was about 40% the supplementary feeds. Further, [13] also concluded that, daily growth rate of *Catla catla* was higher in feeds with 30 and 40% protein.

Further, higher growth rate observed in the study may be also due to the tray feeding (trays were placed at the middle layer of the water) as *Catla catla* is a middle layer feeder. Therefore, fry could have consumed feed freely without wasting energy to find the feeds. Further, as Khan, Ahmed [14] stated, feeding 5.0 - 5.5% of body weight per day could achieve optimum growth

and efficient feed utilization for carps. Hence, properly balanced supplemental feeds with reliable feeding rate may be helpful to enhance the growth of *Catla catla* fry. Composition of feed and the size of the ration are the most important factors affecting growth. The higher growth observed for fish fed with the experimental feeds may be due to different ingredients used in different proportion.

The regression coefficient (b) of four feeds was closed to 03 which indicated, the fish in all treatments showed an isometric growth. It also indicated that, the fish fed with treatment feeds showed a proportional growth with their length and weight (Figures 01 - 04). The reliable b value of near to the 3 may be attributed to nutrient composition of feeds and better ecological factors.

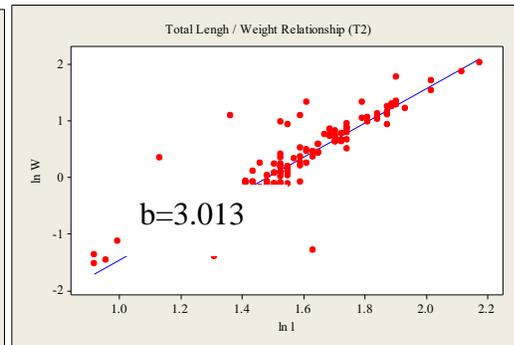
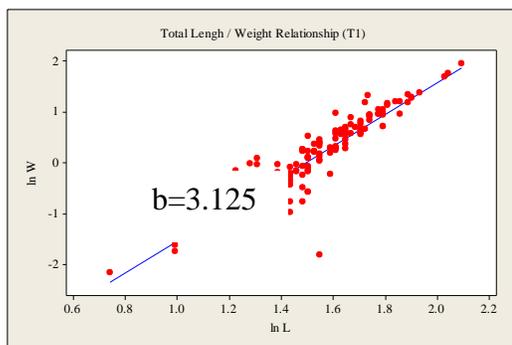


Figure 01 and 02: Total length weight relationship with T1 and T2 feeds

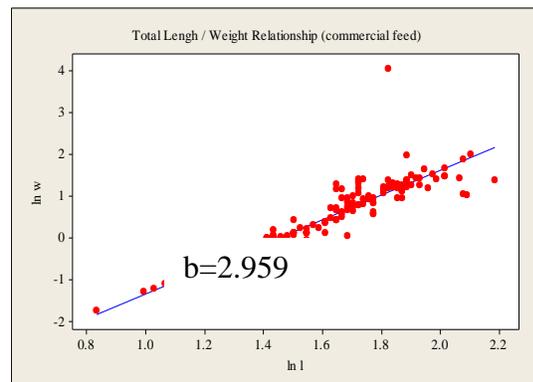
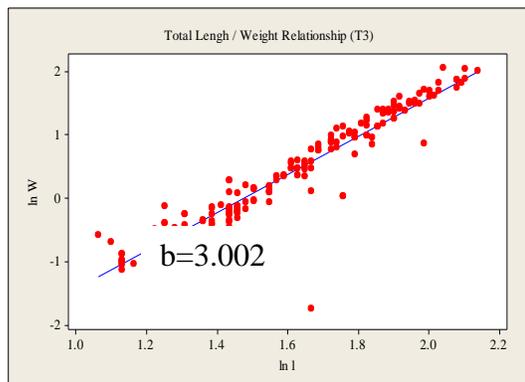


Figure 03 and 04: Total length weight relationship with T3 and commercial feeds

Specific growth rate of fry fed with experimental feeds was significantly different ( $p < 0.05$ ) and the highest was reported with T3. It was lower ( $p < 0.5$ ) in fry fed with aquatic plants in their feeds compared to the fry fed with commercial feed. Further, SGR increased linearly up to the 36.3% protein level and there after it declined. As [Maqbool \[15\]](#) reported, the SGR values of *Cyprinus carpio specularis* increases almost linearly with increasing dietary protein content up to 40% and then reaches a plateau. They further concluded that, highest SGR observed for fish fed with the 40% protein diet. The reduction of SGR values after the 36.3% protein in present study may be due to exceeding of optimum protein requirement of *Catla catla* fry.

Feed Conversion Ratio of fry fed with experimental feeds varied between 0.67 - 0.98, while FCR of T3 feed and commercial feed were significantly lower ( $p < 0.05$ ) compared to the aquatic plants incorporated feeds (Table 03). The results indicated that, a larger quantity of T1 and T2 feeds required for a unit weight gain of fry whereas, T3 and T4 feeds were required in lower quantity. Reduction of FCR value from low protein to high protein incorporated feeds also found by [Kalla, Bhatnagar \[4\]](#). They invaded that FCR values were high for poor protein incorporated feeds and lowest for protein rich diets.

### Survival Rate

Survival rate of the fry varied from 73.7 - 75.3% among the experimental feeds though the values were not significantly differ ( $p > 0.05$ , Table 03). However numerically poor survival rate was found in fish fed on feeds with less protein whereas, higher value with increased protein content in feeds. The results were in accordance with those of [Millamena \[16\]](#), who observed the survival rate increases with increase of protein content in the fish feeds. According to [Kalla, Bhatnagar \[4\]](#), Indian major carps obtain 87.4% - 95.1% survival rate under field conditions. However, the survival rate that obtained in present study was lower than the past studies even in the field condition. The reduction of survival rate of present study may be attributed to the stress due to frequent handling and predatory problems such as dragonfly nymphs, cormorants.

### Water Quality Parameters

Water quality parameters were not significantly changed by different treatments ( $p > 0.05$ ). Water temperature of ponds ranged from 26.5 °C - 29°C during the study period and the water temperature variation of experiment was within the acceptable range (20°C - 28°C) recommended by [Alabaster and Lloyd \[17\]](#). Though the pH of water did not differ significantly with the treatment feed, the highest mean value was recorded in the pond fed with commercial feed (9.0) and lowest value recorded with T1 feed (7.5). The acceptable limit of pH for the freshwater fish was 6.5 - 9.0 [\[18\]](#) and pH was within the favorable range in the present study. The results indicated that, pH of water increased with the increase of protein content in feeds and it agreed with the finding of [Kalla, Bhatnagar \[4\]](#). Feeds with high protein release higher amount of ammonia than the feeds with lower protein and causes increase in pH due to formation of  $\text{NH}_4^+$  complex in water [\[18\]](#).

According to [Boyd \[18\]](#), ammonia concentration between 0.6 and 2.0 mg/L are toxic to many fish species. During the

present experimental period, the ammonia level were found to be low than toxic level in all treatments. The ammonia content in the ponds which were fed with T3 and commercial feed were slightly higher than that of feeds which were incorporated with lower proportion of fish meal (T1 and T2). It was in accordance with the results obtained by [Parameshwaran, Edirisinghe \[19\]](#), which showed that, when fish fed with fish meal based formulated feed, causes a slight increment of ammonia. However, the ammonia level in the present study was within the favorable limits as the highest value recorded was 0.47 mg/L.

Dissolved oxygen levels ranged from 6 - 11 mg/L with the treatment feeds. This range was above to the lethal level of 3.0 mg/L [\[18\]](#). Numerically the highest and lowest mean values were recorded in the ponds which were fed with T1 and commercial feeds respectively and it showed that DO of pond water decreased with increased protein content of feeds. According to [Kalla, Bhatnagar \[4\]](#) the feeds with highest protein content have lower DO value than the feeds with lower protein content. Variation of secchi disk value which was the indication of transparency of water in the pond water ranged between 40 - 25 cm which indicated that natural feeds were available throughout the experiment period at reliable level for the fish growth. Hardness of pond water was not significantly different ( $p > 0.05$ ). It varied from 153 - 220 mg/L and was within the favorable range for freshwater fish since hardness values less than 20 mg/L causes stress and  $> 300$  mg/L is lethal to fish [\[20\]](#).

### Cost Analysis of Formulated Feeds

The cost of formulated feeds showed a remarkable cost reduction with decrease in fish meal content in the test feeds (Table 03). Feed T1, in which 50% of fish meal was replaced by *Hydrilla verticillata* leaf meal seems to be the cheapest among all the feeds, as there is no commercial value for *Hydrilla verticillata* plant at present. *Ipomea aquatica* incorporated feed also could be considered as low cost feed (T2) than the feed prepared by locally available ingredient (T3). The cost for *Ipomea aquatica* incorporated feed depends on the market value, since it is used as a vegetable. However, the cost will be similar to that of *Hydrilla verticillata* incorporated feed when it is freely available. Both aquatic plants could be obtained free from the fish farms, especially in North Central province of Sri Lanka. Small scale farmers can involve their family members to collect the aquatic plants and for further processing. However, the preparation of *Ipomea aquatica* incorporated feed may be a tedious process for large scale farmers, as it contains only immature leaves. However, it will not a problem in small scale production and this should be decided on merits of individual farms with respect to their size, availability of plants, labour etc.

For small scale farmers, the formulated feed T3 which included locally available ingredients have an added advantage over commercial feed due to their better growth performance and cost, in a situation where, low cost ingredients are readily available. Cost for the feed T3 was about 50% less than from the cost of the commercial feed. Since feed cost occupied about 50 - 60% of the operation cost in the semi-intensive carp farming [\[21\]](#), T3 feed is the most cost-effective and affordable feed for the fish farmers compared to commercial feed.

#### IV. CONCLUSIONS

Aquatic plants could be incorporated as a non-conventional source of protein in the feed of *Catla catla* and discarded dried fish meal can also be used as an alternative source of protein for the high cost fish meal. The feed with aquatic plants and locally available ingredients have a good acceptance and palatability. Any of the formulated feeds T1, T2 and T3 does not affect the water quality of the pond. Fry exhibit an isometric growth for all formulated feeds and can obtain well balanced grown fingerlings at the end. Cost of the feed could be cut down up to 70% by using locally available ingredients for feed preparation and this cost can be further cut down by incorporating aquatic plants

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# First study on Antimicrobial activities of Endophytes Isolated from Aerial parts of *Mentha Piperita*

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**Abstract-** Endophytic microbes are considered as an outstanding source of bioactive natural products because there are so many of them occupying millions of unique biological niches growing in different types of environment. Plants infected with endophytes are often healthier than endophytes free ones. These endophytes are the prominent source of secondary metabolites similar to the plant tissue on which these endophytes are grown. The present study illustrates about the isolation and screening of endophytes from aerial parts (leaves and stems) of *Mentha piperita* plant. A total of 4 different bacterial endophytes were isolated from leaves which were marked as L1, L2, L3 and L4 while only 2 different types of bacterial endophytic cultures were isolated from stems of the plant which were marked as S1 and S2. These were categorized and nominated separately as per the colonies growth on LB media. The pure cultures of these bacterial endophytes were isolated and maintained in pure form on LB medium. These bacterial endophytes were further screened for biochemical tests and gram staining in order to confirm the genera of bacteria isolated. There were no viable fungal growth appeared in PDA medium. These bacterial cultures were bacilli, cocci and coco-bacilli. These bacterial cultures were separately inoculated in sterilized LB broth for the production of secondary metabolites from each of the organism. The secondary metabolites were extracted with ethyl acetate followed by drying to yield the crude secondary metabolites. The crude extracts of secondary metabolites were further screened for antimicrobial activity against bacterial and fungal pathogens. The extracts showed significant antibacterial activity against *Leuconostoc mesentroides*, *Bacillus subtilis*, *Bacillus licheniformis* and *Saccharomyces cerevisiae* (yeast).

**Index Terms-** Bacterial endophytes, aerial parts, *Mentha piperita*, LB media, secondary metabolites.

## I. INTRODUCTION

Endophytes are those microorganisms that inhabit interior of plants especially leaves, stems, roots shows no apparent harm to host [1]. Almost all classes of vascular plants and grasses examined to date are found to host endophytic organisms [2]. Different groups of organisms such as fungi, bacteria, actinomycetes and mycoplasma are reported as endophytes of plants [3]. Research of endophytic fungi has a long history and their diversity among plants has been found to be considerably large. Each plant has been reported to harbor one or more endophytes [4, 5]. Recently endophytes are viewed as

outstanding source of secondary metabolites bioactive antimicrobial natural products. These microorganisms received considerable attention in last 20 years when their capacity to protect against insect and pest pathogens was noticed. Endophytes are the prominent source of secondary metabolites which can be potent antimicrobial, antioxidant and anticancer activities. The present study is focused on the isolation and characterization of endophytes from aerial parts of *Mentha piperita* L.

## II. MATERIALS AND METHODS

### Collection and Identification of the plant parts

The aerial parts of *Mentha piperita* L. viz. leaves and stem were collected and were taxonomically identified by some Taxonomists/Botanists in the form of herbarium.

### Surface sterilization of plant tissues and isolation of endophytes

Further the tissues of the plant were soaked in 70% alcohol for few seconds or in 0.5-3.5% sodium hypochlorite for 1-2 minutes followed by rinses in sterile double distilled water before placing it on a LB medium for isolation of endophytic bacteria [6]. Some isolates require months or more time in culture before they sporulate. Even stop sporulating after they have been transferred several times. The LB plates were incubated for about 7-10 days for observation of any growth of bacterial endophytes. For isolation of fungal endophytes surface sterilization of tissue requires 70% ethanol for 1-3 minutes, aqueous sodium hypochlorite (4% available chlorine) for 3-5 minutes again rinse with 70% ethanol 2-10 seconds and final rinse with double distilled water and drying in laminar air flow, also added 50mg/l chloramphenicol within PDA medium to suppress bacterial growth [7]. Sterile knife blade was required to remove outer tissues from sample and to excise inner tissues. The PDA plates were kept for about 5-6 days for observation of growth of any fungal endophytes. All the plates were incubated at 28°C to promote the growth of endophytes and were regularly monitored for any microbial growth. On observing the microbial growth, sub-culturing was done. Each endophytic culture were checked for purity and transferred to freshly prepared PDA plate. Appropriate controls will also be maintained in which no plant tissues were inoculated.

### Maintenance of Endophytes for Identification and Future Use

The purified endophytic isolates were transferred separately to LB/PDA slants and broths depending on the case for bacterial and fungal endophytes respectively and accessioned accordingly depending upon the plant parts from which they have been isolated. Finally all the purified endophytes were maintained at 4°C till further used. Different biochemical tests were done for identification of bacterial and fungal endophytes. The bacterial isolates were tested for their morphological and biochemical characteristics (catalase enzyme activity). Gram stains were performed to determine the characteristics of the cell wall, cell shape and the arrangement of cells. The morphology of the endophytic bacterial strains was observed on slides under a microscope. For staining, 15 µL of a bacterial culture that is grown in nutrient broth overnight at room temperature with shaking at 150 rpm were heat-fixed onto a slide and then stained. The fungal slides if isolated were stained with lactophenol. The structures were observed using a photomicroscope. The samples were then compared to other samples reported in the literature [8-10].

#### **Production of Secondary metabolites**

LB broth was prepared and autoclaved. Endophytic bacterial cultures were inoculated in the broth medium separately within the flasks. These flasks were labeled as L1, L2, L3, L4, S1 and S2. Flasks were then incubated at 28°C for 96 h in incubator shaker at 120 rpm. Further, each of the broth culture was centrifuged at 10,000 rpm to produce the supernatant/filtrate. The extraction of the supernatant/filtrate with different solvents (Chloroform: Ethyl acetate) in 1:1 ratio and left for 15-30 minutes. The organic phase of each of the extracts were collected and kept for drying at 37°C. Further, the dried secondary metabolites were kept in sterilized vials for future use.

#### **Determination of antimicrobial activity of the secondary metabolites**

##### **Culture Media**

Soyabean casein digest agar/broth and Sabouraud's dextrose agar/broth of Hi Media Pvt. Bombay, India were used for antibacterial and antifungal activities respectively.

##### **Inoculum of pathogenic microbes**

The pathogenic microbes viz. *Leuconostoc mesentroides*, *Bacillus subtilis*, *Bacillus licheniformis* and *Saccharomyces cerevisiae* (yeast) were inoculated into Soyabean casein digest broth and Sabouraud's dextrose broth followed by incubation at 35°C for 48 h and suspension was checked to provide approximately,  $2 \times 10^5$  CFU/ml.

##### **Determination of diameter of zone of inhibition by well diffusion method**

The agar well diffusion method was modified [11]. Soyabean Casein Digest agar medium (SCDM) was used for bacterial cultures. The culture medium was inoculated with the pathogenic bacteria separately suspended in nutrient broth. A total of 8 mm diameter wells were punched into the agar and filled with metabolite extracts and solvent blanks. Standard antibiotic (Erythromycin and Fluconazole, 1 mg/ml) were simultaneously used as the positive controls. The plates were incubated at 37°C for 18 h for bacterial growth and 28°C for 48 h for fungal growth. The antibacterial and antifungal activities were evaluated by measuring the diameter of zone of inhibition observed.

##### **Determination of Minimum Inhibitory Concentration (MIC)**

MIC values of potent antimicrobial metabolites were determined by the method adopted with some modifications [12, 13]. Metabolites extracted prepared in highest concentration (200 µg/ml) in sterile distilled water and were serially diluted with N-saline (0.85 % NaCl) and similar quantity of bacterial/fungal suspension were added to respective test tubes and incubated for 48 h. The inhibition of turbidity appeared in the minimum dose at which total growth of bacteria/fungus gets killed is known as minimum lethal concentration (MLC) while little turbidity appeared in the minimum amount of dose of plant extract which inhibits the growth of bacteria/fungus is known as Minimum inhibitory Concentration (MIC).

### **III. RESULTS AND DISCUSSION**

The present investigation reveals the isolation of 4 different pure cultures of bacterial endophytes from leaves named as L1, L2, L3 and L4 and 2 different pure bacterial endophytic cultures from stems of *Mentha piperita*, named as S1 and S2. The results are shown in **Figures 1-4**. These bacterial endophytes were further screened for biochemical tests and gram staining (**Figure 5 & Table 1**) in order to confirm the biochemical characterization of the isolated bacterial colonies. These bacterial cultures were determined as bacilli, cocci and coco-bacilli as gram positive and gram negative colonies. There were no viable fungal growth appeared in PDA medium. This is the first kind of study reported for the isolation of bacterial endophytes and production of secondary metabolites from leaves and stems of *Mentha piperita* L. The secondary metabolites (**Figure 6**) were extracted from each of the endophytic bacterial strains and antimicrobial activity was evaluated against *Leuconostoc mesentroides*, *Bacillus subtilis*, *Bacillus licheniformis* and *Saccharomyces cerevisiae* (yeast). The crude dried extract of each of the secondary metabolite was dissolved in DMSO to obtain the concentration viz. 200 µg/ml. Further, the antimicrobial activity was determined against the concerned pathogens. It was found that, secondary metabolites from S2 and L4 had potent antibacterial activity against *Leuconostoc mesentroides* while, S1, L1, L2 and L3 had no activity against the concerned pathogen. The secondary metabolites from L3 had potent antibacterial activity against *Bacillus subtilis* while no other endophytic metabolite was found antibacterial against the same organism. The metabolites from S1, S2, L3 and L4 showed potency against *Bacillus licheniformis* while no antibacterial activity of L1 and L2 was recorded against the same organism. Dominant antibacterial activity of L2, L3 and L4 was found against *Saccharomyces cerevisiae* (yeast) followed by slight antibacterial activity of S1 while no antibacterial activity was reported of L1 and S2 against the same organism (**Figure 7 & Table 2**). Further MIC and MLC values were determined of the potent extracts by serial dilution technique (**Table 3**). The endophytic ascomycetes group fungal cultures were isolated and checked for the effects on the growth of peppermint [14, 15].

### **IV. CONCLUSION**

The present study determines the four different endophytic bacterial strains from leaves viz. gram positive, Bacilli, non-

motile, spore forming (L1), gram positive, Bacilli, non motile, non spore forming (L2), Gram positive, Bacilli, non motile, non spore forming (L3) and gram positive, Bacilli, non motile, non spore forming (L4) while two different bacterial endophytic bacterial strains were isolated from stems viz. Gram negative, Cocci, motile, non spore forming (S1) and Gram negative, Cocco-bacilli, motile, non spore forming (S2). This endophytes bacterial strain illustrates the bacterial endophytic diversity in the

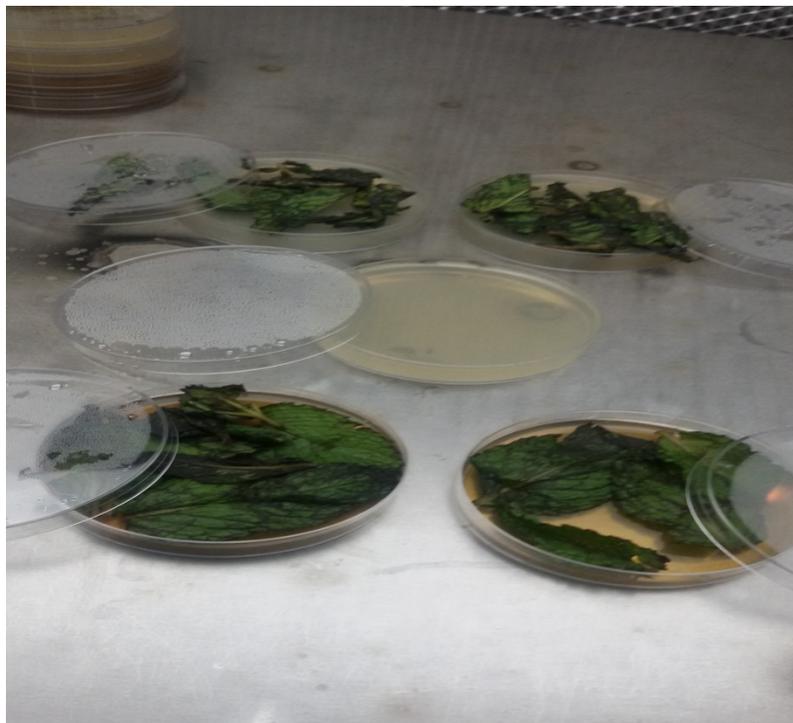
aerial parts of *Mentha piperita* plant. However, no fungal endophytes were isolated in the present study. The present investigation will help to explore endophytes as per the variation of species, climate and regions variability in *Mentha piperita* L. These endophytes produce antibacterial compounds which have potent antibacterial activities. Further, these compounds should be investigated and determined.



**Figure 1:** Leaves and stem twigs of *Mentha piperita*



**Figure 2 (a):** Surface sterilized stem of *Mentha piperita* on LB and PDA plates



**Figure 2 (b):** Surface sterilized stem of *Mentha piperita* on LB and PDA plates



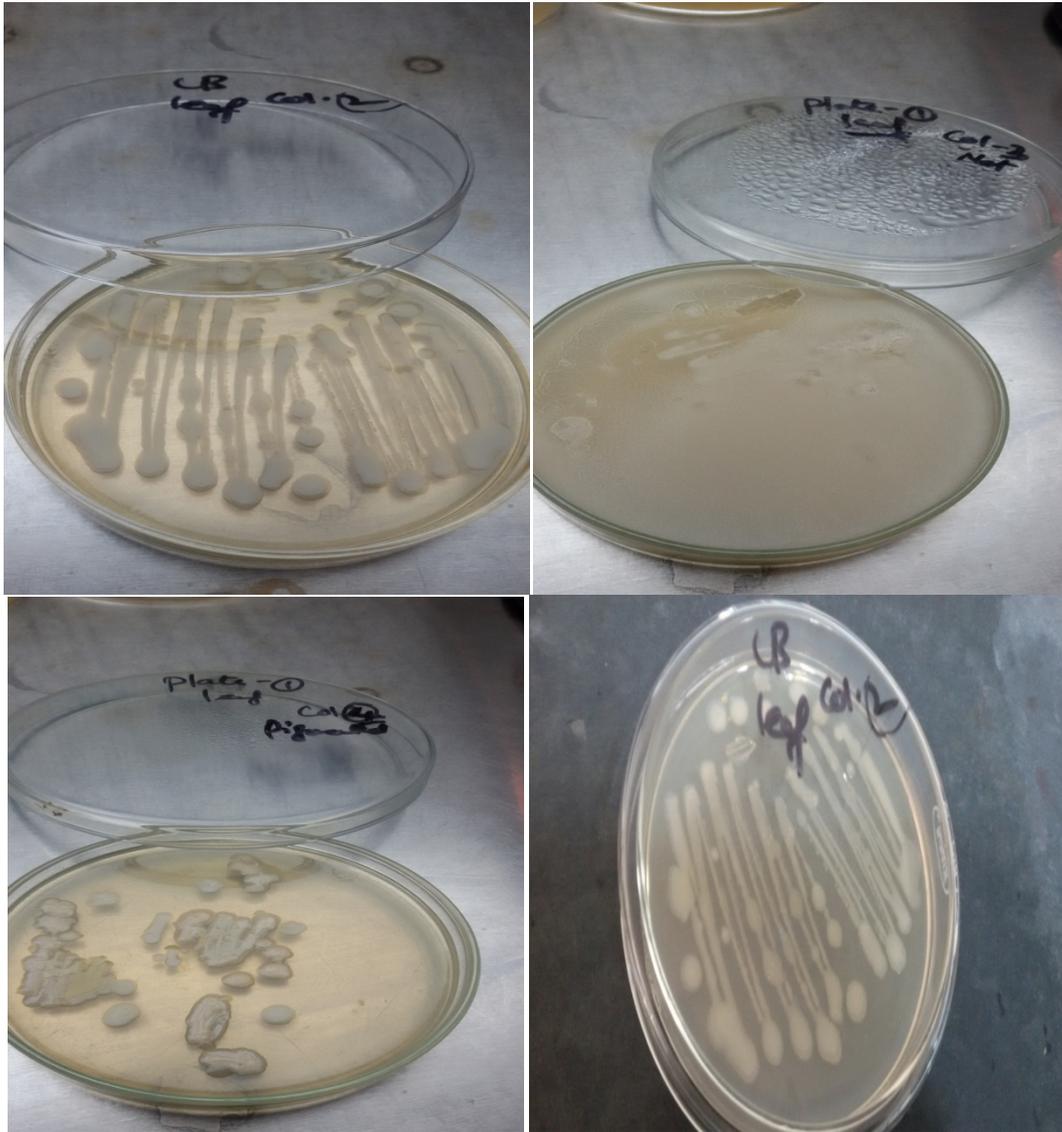
**Figure 3 (a):** Bacterial endophytes growth in stems of *Mentha piperita* on LB plates



**Figure 3 (b):** Bacterial endophytes growth in leaves of *Mentha piperita* on LB plates



**Figure 4 (a):** Bacterial endophytic pure cultures isolated from stem of *Mentha piperita* on LB agar



**Figure 4 (b):** Bacterial endophytic pure cultures isolated from leaves of *Mentha piperita* on LB agar

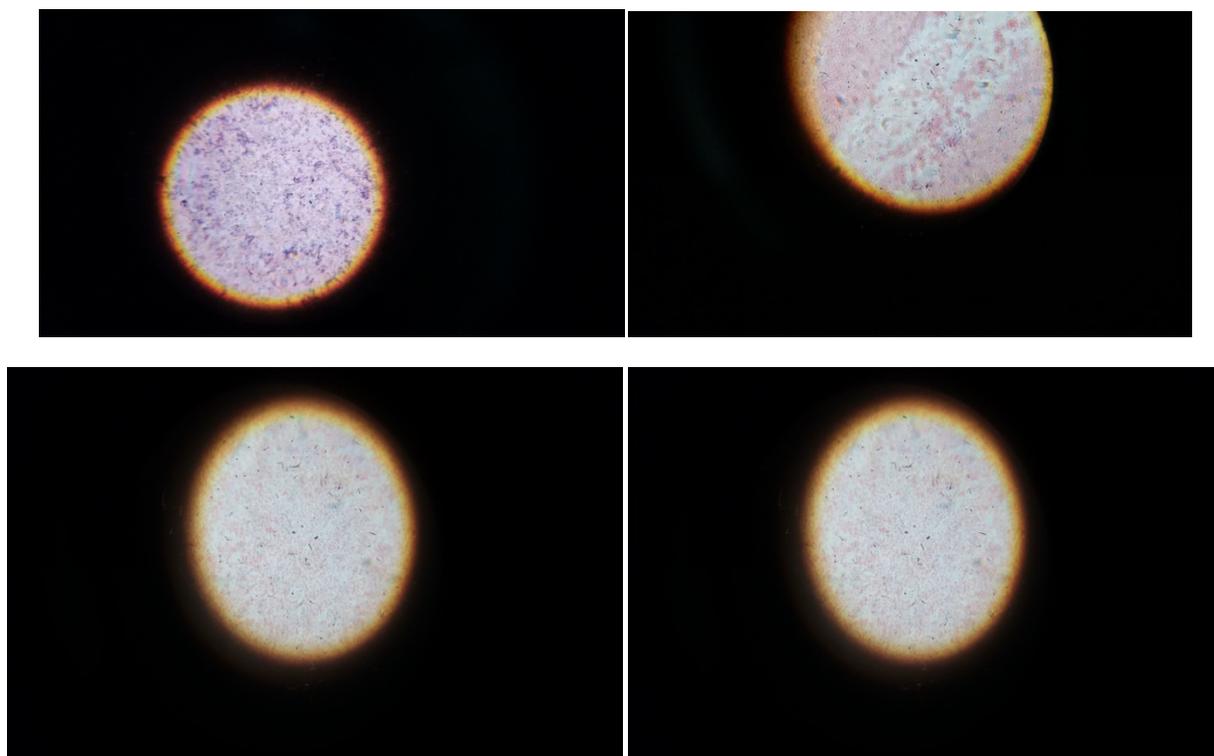


Figure 5: Microscopic gram staining images of the isolated bacterial cultures

Table 1 (a): Morphology and Biochemical Characteristics of Gram positive Bacterial endophytes

Isolate	Gram Staining/Shape/Motility/Spore formation	Sugar Fermentation Test	Amylase test	Indole test	Methyl red test	VP test	H <sub>2</sub> S production	Citrate test
L1	Gram positive, Bacilli, non-motile, spore forming	+	+	-	+	-	-	-
L2	Gram positive, Bacilli, Non motile, Non spore forming	+	+	-	+	-	-	+
L3	Gram positive, Bacilli, Non motile, Non spore forming	+	+	-	+	-	+	-
L4	Gram positive, Bacilli, Non motile, Non spore forming	+	+	-	+	-	-	-

+, present; -, absent

Table 1 (b): Morphology and Biochemical characteristics of Gram negative Bacterial endophytes

Isolate	Gram Staining/Shape/Motility/Spore formation	Sugar Fermentation Test	Amylase test	Indole test	Methyl red test	VP test	H <sub>2</sub> S production	Citrate test
S1	Gram negative, Cocci, motile, non spore forming	+	+	+	-	+	+	+
S2	Gram negative, Cocco-Bacilli, motile, Non spore forming	+	+	-	+	+	+	+

+, present; -, absent

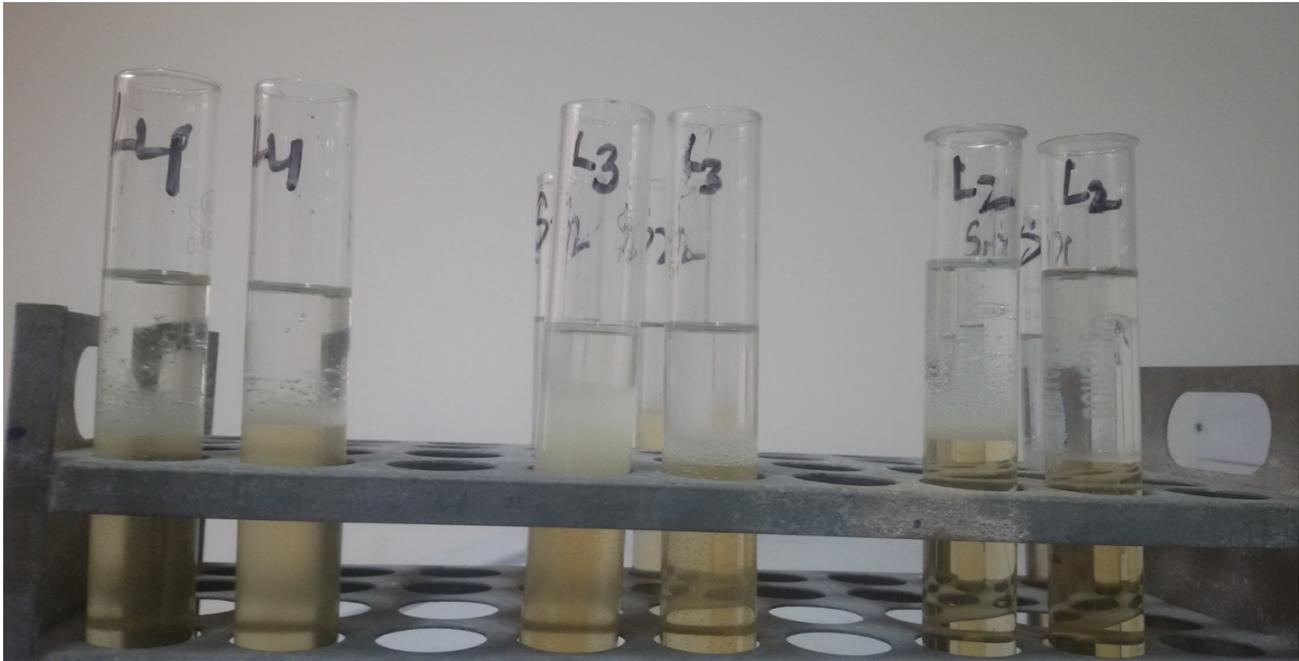
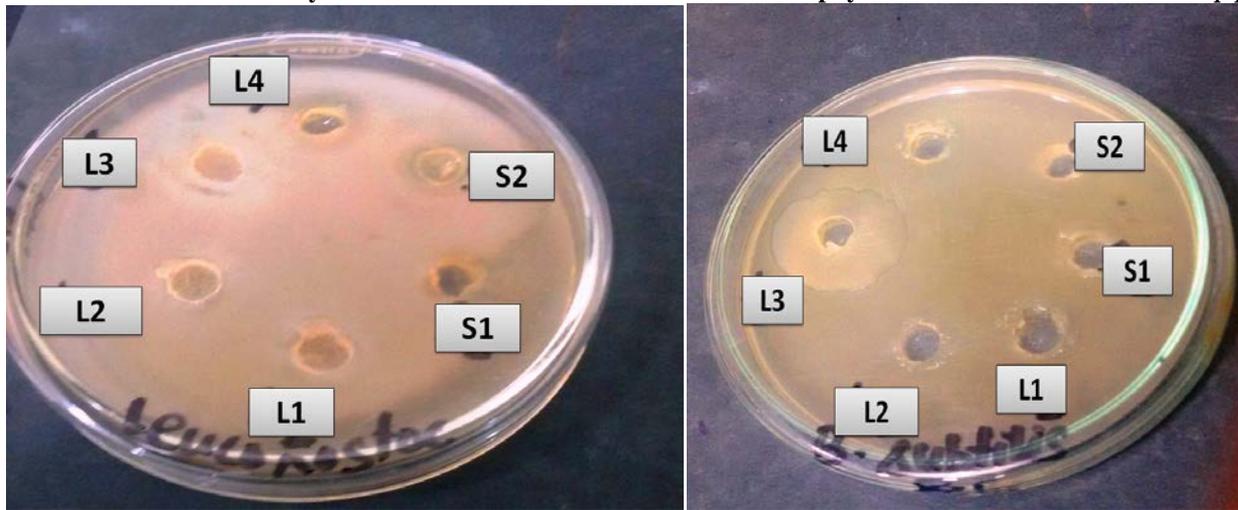
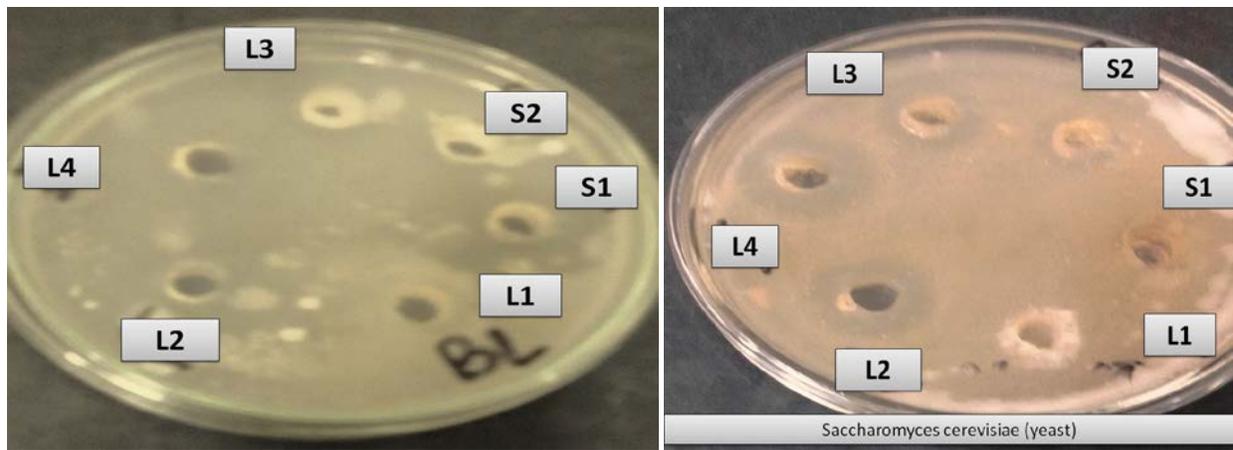


Figure 6: Extraction of secondary metabolites from each of the bacterial endophytic strain isolated from *Mentha piperita*



(A) (B)



(C)

(D)

Figure 7: Antimicrobial Activity of the secondary metabolites extracted and purified from different endophytic bacterial cultures of leaves and stems of *Mentha piperita*

**Table 2: Antimicrobial activity of secondary metabolites (200 µg/ml) against the selected pathogens**

Endophytic metabolites of isolated endophytes	Diameter of zone of inhibition (mm)			
	LM	BS	BL	SC
L1	NA	NA	NA	NA
L2	NA	NA	NA	35.0
L3	NA	35	25.0	27.0
L4	14.0	NA	27.0	40.0
S1	NA	NA	12.0	NA
S2	15.0	NA	12.0	15.0

\*LM, *Leuconostoc mesentroides*, BS, *Bacillus subtilis*, BL, *Bacillus licheniformis*, SC, *Saccharomyces cerevisiae*. NA, no activity

**Table 3: MICs and MLCs of the potent metabolites against the selected pathogens**

Endophytic metabolites of isolated endophytes	MIC		MLC	
<b>Leuconostoc mesentroides</b>	30 (L4)	40 (L4)	30 (S2)	30 (S2)
	20 (S2)			
<b>Bacillus subtilis</b>	50 (L3)	75 (L3)		
<b>Bacillus licheniformis</b>	30 (L3)	50 (L3)		
	45 (L4)	75 (L4)		
	55 (S1)	85 (S1)		
	55 (S1)	85 (S1)		
<b>Saccharomyces cerevisiae</b>	10 (L4)	20 (L4)		
	25 (L3)	45 (L3)		
	30 (L3)	50 (L3)		
	30 (L4)	40 (L4)		

\*LM, *Leuconostoc mesentroides*, BS, *Bacillus subtilis*, BL, *Bacillus licheniformis*, SC, *Saccharomyces cerevisiae*. NA, no activity

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# Geotechnical Investigation at Various Locations in Bangalore

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**Abstract-** This report is brief description and summary of my work that I performed during the internship period in Karnataka Test House Pvt. Ltd.

Karnataka Test House Pvt. Ltd is a service oriented organization established with objective of providing professional and high level service. The Geotechnical department looks after the various field and laboratory testing. The department is also responsible for business development of company. The working experience with a consultancy like Karnataka Test House Pvt. Ltd has helped to understand better the functioning and working of the organization, structure and setting up of projects.

At last this internship has given a new insights and motivations to pursue a career in geotechnical engineering in India or abroad.

**Index Terms-** Boreholes, SPT, Disturbed and undisturbed samples, Basic tests.

## I. INTRODUCTION

The knowledge of subsoil condition at a site is a pre requisite for safe and economical design of subsurface elements. The field and laboratory studies carried out for obtaining the necessary information about the subsoil characteristics including the position of ground water are termed as Geotechnical investigation. Necessary information with regards to the strength and compressibility characteristics of the subsoil to allow the Design Consultant to make recommendations on the safe bearing pressure.

As the variability of the soil strata is found to increase the extent of investigation is also increased. On the other hand, if the site is found to be underlain by uniform deposits, the extent of investigations is decreased.

At the start of internship work in the company, was aware of only the theoretical knowledge of the works and some

practical knowledge regarding laboratory experiments. It was really fascinating and inspiring to see and experience the lessons learnt been put to use in practice. Gained skills and knowledge would be put to use in the best possible way, and would continue to work on their improvement, in order to attain desired career objectives and express more confidently.

**Karnataka Test House Pvt. Ltd., (KTH)** was started in the year 1989 with the basic aim of undertaking consultation in the field of Geotechnical Engineering, Cement Concrete Technology, Building and Highway materials testing and Non-Destructive and Semi Destructive testing by Ultrasonic Pulse velocity test and Rebound Hammer Tests. The Laboratory has an extensive range of sophisticated testing equipment's and is staffed by a team of experts.

Company offers accurate, reliable and prompt testing services as per the guidelines laid down in Bureau of Indian Standards (BIS). The Services are being utilized by Central / State Government departments, Semi-Government agencies, Industrial Organizations and many Private agencies.

The test results are used as first level quality control measures in a quality assurance plan. Our laboratory is located in a spacious place; the organization is well equipped to conduct field and laboratory investigations and is manned by well qualified professionals. Apart from these professionals, we also have advisors who help us as and when required in solving critical assignments.

The laboratory has been assessed and accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) in accordance with the Standard ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories" for its facilities at Bangalore in the field of Mechanical Testing and Non-Destructive Testing vide Certificate Number T-0901 and T-1819. The scope of testing includes testing of cement, soil and building materials.



**Fig. 1.1 Karnataka Test House Pvt. Ltd. - Office and Laboratory**

## II. GEOTECHNICAL DEPARTMENT

**Karnataka Test House Pvt Ltd.** is a company which offers consultancy services in the field of Geotechnical Engineering, Building and Highway Materials Testing, Cement concrete Technology and Non-Destructive and Semi Destructive testing by Ultrasonic Pulse Velocity and Rebound Hammer tests. The internship work was carried out in this company for the last five months i.e., from July to November, 2015. During this period, the internship work was done in the Geotechnical Department. The following are the different projects taken up during the course of the internship programme:-

**Project – 1** - Proposed Construction of Retaining Wall near Tumkuru road, Bangalore Nelamangala Section of NH-4.

**Project – 2** - Proposed construction of residential building at vasanth nagar, Bangalore

### **Geotechnical Investigation: -**

The knowledge of subsoil condition at a site is a pre requisite for safe and economical design of subsurface elements. The field and laboratory studies carried out for obtaining the necessary information about the subsoil characteristics including the position of ground water are termed as Geotechnical investigation.

### **Geotechnical Investigation.**

- Site investigation or subsurface explorations are done for obtaining the information about subsurface condition at the site of proposed construction.

- Site investigations consist of determining the profile of the natural soil deposits at the site, taking the soil samples and determining the engineering properties of the soils.

- The field and laboratory studies carried out for obtaining the necessary information about the subsoil characteristics including the position of ground water are termed as Geotechnical Investigation.

- The site investigation is thus able to give information about following:

- Depth and composition of soil strata.
- depth of rock, when necessary.
- Ground water level
- Engineering properties of samples.
- Soil bearing capacity
- selection of foundation type.

### **Stages in Sub-Surface Exploration: -**

Sub-surface explorations are generally carried out in three stages:

#### **i. Reconnaissance:**

- This includes a visit to the site and to study site plan by the Geotechnical Engineer or Site In-charges.
- It helps in deciding future programme of site investigations, scope of work, methods of exploration to be adopted, types of samples to be taken and the laboratory testing and in-situ testing.

#### **ii. Preliminary Explorations:**

- This is to determine the depth, thickness, extent and composition of each soil stratum at the site location and in the form of a few borings or tests pits.
- Tests are conducted with sounding method such as Standard Penetration test and geophysical methods such as electrical

resistivity method are used in preliminary explorations for locating the boundaries of different strata so as to obtain information about the strength and compressibility.

### iii. Detailed Explorations:

- This is to determine the engineering properties of the soils in different strata and includes testing of the samples in the laboratory.
- Field tests such as Plate Load tests and permeability tests are conducted to determine the properties of the soils in natural state.

### Methods of Exploration – Field Investigation: -

- Open excavation
- Borings
- Sub- surface sounding
- Geophysical methods

1. **Open excavation:** - Open excavation is made to inspect the sub strata, the methods can be of two categories **pits and trenches and drifts and shafts**. It's generally considered for the shallow depths (about 6m).

2. **Borings:** - When the depth of exploration is large, boring is used for exploration. A vertical bore hole is drilled in the ground to get the information about the sub soil strata. The following methods are used for drilling the holes, are **Auger**

**boring, Wash boring, Rotary drilling, percussion drilling, core boring.**

### Manual auguring: -

- **Equipment used is of Helical or Hand auger.**
- **Samples is of disturbed samples.**

**Rotary boring:** - In the rotary drilling method, the bore hole is advanced by rotating a hollow drill rod which has a cutting bit at its lower end. A drill head is provided at the top of the drill rod. It consists of a rotary mechanism and an arrangement of applying downward pressure. When the soil samples is required to be taken, the drilling rod is raised and the drilling bit is replaced by a sampler. Usually a water solution of bentonite with or without other admixtures is continuously forced down the hollow drill rods.

### Methods of Sampling: -

- Undisturbed soil samples are collected in 100 mm diameter thin walled sampler (Shelby tube) from the borehole.
- Disturbed representative samples were collected, logged, labeled and placed in polythene bags.



Fig 2.1: - Undisturbed soil sample



Fig2.2: - Disturbed soil sample

### Sub- surface sounding: -

- **Standard Penetration Test(SPT) IS: 2131 -1981: - Components: -**

- Drilling Equipment – Manual Auguring
- Inner diameter of hole - 100 to 150 mm
- Casing - soft/non-cohesive soils
- Split spoon sampler IS: 9640-1980
- Drive weight assembly
- Falling Weight = 63.5 Kg
- Fall height = 750 mm

- After the seating drive of 150mm, the split spoon sampler is further driven by 300 mm
- The number of blows required to drive each 150 mm penetration is recorded.
- Total blows required for the second and third 150 mm penetration is termed as a penetration resistance -N value
- The N-values for each bore hole are given in bore logs
- The test is continued till the relevant depths from the existing ground level or  $N > 15$  or  $N > 100$  or Hard strata encountered in 3m from GL whichever earlier is taken.



Fig2.4: - SPLIT SPOON SAMPLER

Fig 2.3: - SPT TEST

• **Plate Load and K-Value Test: -**

Determination of allowable bearing capacity of sub soil and the modulus of subgrade reaction (K) useful for design of pavements.

Suitable for gravel/boulder strata when SPT and DCPT does not give dependable results.

• **In-Situ Density Test (Core Cutter and Sand Replacement):-**

The tests are conducted as per IS 2720-28 (1974): Methods of test for soils, Part 28: Determination of the dry density of soils in place by the sand replacement method.

IS 2720-29 (1975): Methods of test for soils, Part 29: Determination of the dry density of soil in place by the core cutter method

**Geophysical methods: -**

A number of geophysical methods are used in preliminary investigation of sub soil strata. The methods can be for the location of different strata and for rapid evaluation of the subsoil characteristics. The geophysical methods can be broadly divided into the two categories **Seismic methods and Electrical resistivity methods.**

**Laboratory Investigation: -**

The following experiments/ tests are conducted on the soil sample obtained based on the requirement of the client:

- **Determination of water content- IS: 2720 (Part 2)-1973.**
- **Grain size analysis - IS: 2720 (Part 4) – 1985.**

- **Determination of Liquid and Plastic Limit - IS: 2720 (Part 5) – 1985**

**Liquid limit: -**

**Casagrande's Apparatus  
Cone Penetration method**

**Plastic Limit**

- **Determination of water content- dry density relation using light compaction - IS: 2720 (Part 7) – 1980 .**

- **Determination of water content- dry density relation using heavy compaction - IS: 2720 (Part 8) – 1983 .**

- **Direct shear test - IS: 2720 (Part 13) – 1986.**

- **Hydrometer analysis – IS: 2720- Part -4 (1985)**

- **Determination of soaked CBR - IS:2720 (Part 16).**

- **Determination of specific gravity- fine grained soil - IS:2720 (Part -3 Section 1) – 1980.**

- **Determination of specific gravity- fine, medium and coarse grained soil - IS:2720 (Part -3 Section 2 ) – 1981.**

- **Determination of the differential free swell index of soil - IS: 2720 (Part 40) – 1977.**

- **Laboratory Determination of Permeability-**

**Constant Head Permeability test - IS: 2720- Part 36(1987)**

**Falling Head Permeability test - IS: 2720- Part 17(1986)**

- **Determination of shear strength parameters of soils from consolidated undrained Triaxial compression test without measurement of pore water pressure – IS: 2720 (Part 11- 1971)**

- **Determination of shear strength parameters of soils from consolidated undrained Triaxial compression test with measurement of pore water pressure – IS: 2720 (Part 11- 1971)**

- **Determination of consolidation properties –IS: 2720 (Part 15)-1986**

- **Determination of density index or relative density of cohesion less soils – IS: 2720 (Part 14) -1983 .**

- **Determination of Unconfined Compressive strength – IS:2720 (Part 10)-1973 .**

### STRUCTURAL DEPARTMENT

The Department is headed by a Geotechnical Engineer and has a laboratory technician with a team of laboratory assistants to perform the day to day activities of the laboratory. The Outdoor or In-situ activities are monitored by two Site In-charges and have a team of skilled labourers.

The signing authority of the geotechnical report is the Technical Manager of the company.

### TECHNICAL MANAGER

### GEOTECHNICAL ENGINEER

### LABORATORY TECHNICIAN IN-CHARGES

### LABORATORY ASSISTANTS LABOURERS

### SITE

### SKILLED

Geotechnical services from KTH - ensure that the site can accommodate any construction project.

### III. TASK PERFORMED

The internship work was carried out in this company for the last four months i.e., from July to November, 2015. During this period, the internship work was done in the Geotechnical Department as an Assistant Geotechnical Engineer (Intern) and

had taken up three projects i.e., different site location which dealt with the soil exploration/geotechnical investigation of that particular site location.

The following mentioned are the different projects taken up during the course of the internship programme: -

**Project – 1** - Geo-Technical Investigation conducted for Proposed Construction of Retaining Wall near Tumkuru road, Bangalore Nelamangala Section of NH-4

**Project – 2** – Proposed construction of residential building at vasanth nagar, Bangalore.

### Field Investigations

- Taking up the physical observations and general survey of site location of different projects.
- Overseeing the process of advancing boreholes up to relevant depths from the existing ground level or refusal whichever is earlier by means of manual auguring or rotary drilling.
- Overseeing conduction of Standard penetration tests as per IS 2131-1981 at relevant depths.
- Preparing bore logs of the subsurface strata at specified locations.
- Collection of undisturbed samples at specified depths for determination of Cohesion C and Friction factor  $\phi$  as per IS 2720-1986.
- Collection of disturbed soil samples at specified depths for conducting grain size analysis, determination of proctor density, water content, liquid limit and plastic limit.

### PROJECT 1

### Name of the project: -

Proposed Construction of Retaining Wall near Tumkuru road, Bangalore Nelamangala Section of NH-4 .

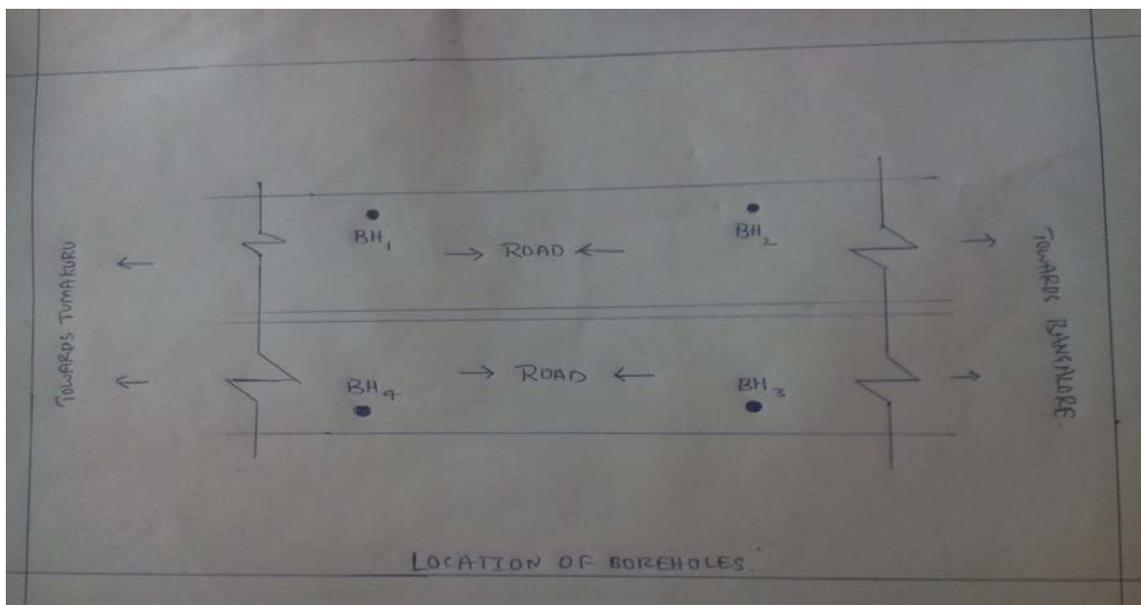


Fig 3.1: - Site location plan

Soil samples obtained: -

Disturbed and undisturbed soil samples are obtained in the field.

- TESTS REPORTS ON SOIL SAMPLES: - **SIEVE ANALYSIS**

**BORE HOLE 1:-**

**Table no 3.1:- Results on sieve analysis of Borehole 1**

BH. No.	Depth in m	Gravel in %	Sand in %			Silt and clay in %	Liquid limit in %	Plastic limit in %	Plasticity index
			C	M	F				
1	2.0	17	07	31	18	27	26	18	08
1	3.5	4	05	42	30	19	32	20	12
1	5.5	4	02	30	33	31	40	24	16

**SOIL CLASSIFICATION (IS: 1498– 1970):- IS OF SILTY SAND WITH CLAY BINDER FOR BOREHOLE 1 AT ALL DEPTH**

**BORE HOLE 2**

**Table no 3.2:- Results on sieve analysis of Borehole 2**

BH. No.	Depth in m	Gravel in %	Sand in %			Silt and clay in %	Liquid limit in %	Plastic limit in %	Plasticity index
			C	M	F				
1	2.0	17	07	31	18	27	26	18	08
1	3.5	4	05	42	30	19	32	20	12
1	5.5	4	02	30	33	31	40	24	16

**SOIL CLASSIFICATION (IS : 1498– 1970):- IS OF SILTY SAND WITH CLAY BINDER FOR BOREHOLE 2 AT ALL DEPTH**

**BORE HOLE 3**

**Table no 3.3:- Results on sieve analysis of Borehole 3**

BH . No.	Depth in m	Gravel in %	Sand in %			Silt and clay in %	Liquid limit in %	Plastic limit in %	Plasticity index
			C	M	F				
3	2.0	04	0	3	2	35	44	30	14
			4	5	2				
3	3.5	05	0	4	2	27	38	26	12
			3	4	1				
3	5.5	32	1	2	1	15	24	NP	Nil
			5	7	1				

**SOIL CLASSIFICATION (IS : 1498– 1970):- SILTY SAND WITH CLAY BINDER FOR DEPTH 2m &3.5m, SILTY SAND WITH GRAVEL FOR DEPTH 5.5m.**

**BORE HOLE 4**

**Table no 3.4: - Results on sieve analysis of Borehole 4**

BH. No.	Depth in m	Gravel in %	Sand in %			Silt and clay in %	Liquid limit in %	Plastic limit in %	Plasticity index
			C	M	F				
4	2.5	16	12	31	16	25	28	20	08
4	4.0	01	08	38	20	33	30	20	10
4	5.5	03	03	23	40	31	28	18	10

**SOIL CLASSIFICATION (IS: 1498– 1970): - SILTY SAND WITH CLAY BINDER FOR ALL DEPTH**

**DIRECT SHEAR: -**

**Table no 3.5:- Results on Direct shear test of Borehole 1 to Borehole 4**

Normal stress in kg/cm <sup>2</sup>	Shear stress in kg/cm <sup>2</sup>
0.5	0.65
1.0	1.2
1.5	1.7

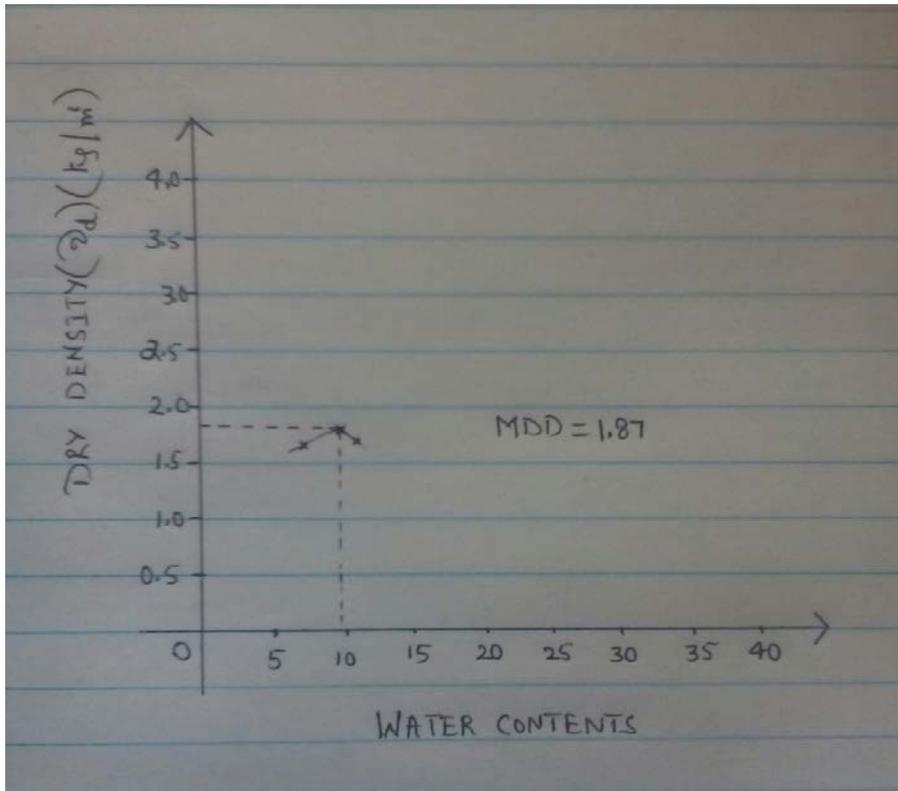
BH No	Depth in m	C T/m <sup>2</sup>	$\phi$
1.Ch:17+350 RHS	1.5	0.60	25
2.Ch:17+150 RHS	1.5	0.30	26
3.Ch:17+150 LHS	1.5	0.40	26
4.Ch:17+350 LHS	1.5	0.30	26

**Table no 3.6: - C and  $\phi$  values**

**COMPACTION TEST**

**Table no 3.7: - Results on Compaction test of Borehole 1 to Borehole 4**

BH. No.	Depth in m	Field Moisture Content %	<sup>b</sup> kg/m <sup>3</sup>	<sup>d</sup> kg/m <sup>3</sup>	Optimum Moisture content in %	Maximum dry density kg/m <sup>3</sup>
1.Ch:17+350 RHS	1.5	7.80	1.85	1.69	12	1.87
2.Ch:17+150 RHS	1.5	9.79	1.96	1.78	12	1.85
3.Ch:17+150 LHS	1.5	10.19	1.82	1.67	12	1.88
4.Ch:17+350 LHS	1.5	9.15	1.87	1.74	12	1.85



**MDD for borehole 1**

**BORELOGS**



**KARNATAKA TEST HOUSE PVT. LTD.**  
NABL Accredited Laboratory as per ISO/IEC 17025

**B O R E L O G**

Project No/KTH/SI/3560/2016-17

**CLIENT :** M/s. Navayuga Engineering Company Ltd.,  
#002, Crescent Heights, 1st Cross, Snehanagar,  
Amruthahalli Main Road, Bangalore-92.

**PROJECT :** Proposed Construction of Retaining Wall near BIEC Location, Bangalore –  
Nelamangala Section of NH-4 from Km.10+000 to 29+500.

**Type of Drilling :** Manual Auguring method.

**BH NO :** 01 17+350 RHS

**GWL :** Not Encountered

Depth below EGL (M)	Soil Description	Thick-ness of Strata (m)	Legend	Details of Sampling		Standard Penetration Test Data		
				Depth (m)	Type	Depth (m)	"N" Value	Rel. density or consistency
0	Filled Up (Asphalt and WMM layer)	1.50		0.00				
1				1.50	UDS			
2	Reddish Brown Silty sand with clay binder	1.00		2.0	SPT	2.0	4/3/2 N=5	
3	Greyish Brown silty sand with clay binder	4.50		2.50				
4				3.5	SPT	3.5	9/10/11 N=21	
5				5.5	SPT	5.5	14/18/23 N=41	
6				6.00				
7								

Bore hole is terminated at 6.0m from the Existing ground level.

EGL - Existing Ground Level

GWL - Ground water level

UDS - Undisturbed sample

SPT - Standard Penetration Test

DS - Disturbed sample

\* - Sample not retrieved.



**KARNATAKA TEST HOUSE PVT. LTD.**  
NABL Accredited Laboratory as per ISO/IEC 17025

**BORE LOG**

Project No/KTH/SI/3560/2016-17

**CLIENT :** M/s. Navayuga Engineering Company Ltd.,  
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Amruthahalli Main Road, Bangalore-92.

**PROJECT :** Proposed Construction of Retaining Wall near BIEC Location, Bangalore –  
Nelamangala Section of NH-4 from Km.10+000 to 29+500.

**Type of Drilling :** Manual Auguring method.

**BH NO :** 02 17+150 RHS

**GWL :** Not Encountered

Depth below EGL (M)	Soil Description	Thick-ness of Strata (m)	Legend	Details of Sampling		Standard Penetration Test Data		
				Depth (m)	Type	Depth (m)	"N" Value	Rel. density or consistency
0				0.00				
1	Filled Up (Asphalt and WMM layer)	1.50						
2	Reddish Brown Silty sand with clay binder	1.00		1.50	UDS			
					SPT	2.0	5/7/8	N=15
3				2.50				
4	Greyish Brown silty sand with clay binder	4.50			SPT	3.5	8/9/10	N=19
5								
6					SPT	5.5	8/16/18	N=34
7				6.00				

Bore hole is terminated at 6.0m from the Existing ground level.

EGL - Existing Ground Level

UDS - Undisturbed sample

DS - Disturbed sample

GWL – Ground water level

SPT - Standard Penetration Test

\* - Sample not retrieved.



**KARNATAKA TEST HOUSE PVT. LTD.**  
NABL Accredited Laboratory as per ISO/IEC 17025

**BORE LOG**

Project No/KTH/SI/3560/2016-17

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**PROJECT :** Proposed Construction of Retaining Wall near BIEC Location, Bangalore –  
Nelamangala Section of NH-4 from Km.10+000 to 29+500.

**Type of Drilling :** Manual Auguring method.

**BH NO :** 03 17+150 LHS **GWL :** Not Encountered

Depth below EGL (M)	Soil Description	Thick-ness of Strata (m)	Legend	Details of Sampling		Standard Penetration Test Data		
				Depth (m)	Type	Depth (m)	"N" Value	Rel. density or consistency
0				0.00				
1	Filled Up (Asphalt and WMM layer)	1.50						
2	Reddish Brown Silty sand with clay binder	1.00		1.50	UDS			
					SPT	2.0	4/5/6	N=11
3				2.50				
4	Greyish Brown silty sand with clay binder	3.50			SPT	3.5	7/8/9	N=17
5				5.00				
6	Greyish white soft disintegrated rock	1.00			SPT	5.5	40/45/50	N=95
7				6.00				

Bore hole is terminated at 6.0m from the Existing ground level.

EGL - Existing Ground Level

GWL - Ground water level

UDS - Undisturbed sample

SPT - Standard Penetration Test

DS - Disturbed sample

\* - Sample not retrieved.



**KARNATAKA TEST HOUSE PVT. LTD.**  
NABL Accredited Laboratory as per ISO/IEC 17025

**BORE LOG**

Project No/KTH/SI/3560/2016-17

**CLIENT :** M/s. Navayuga Engineering Company Ltd.,  
#002, Crescent Heights, 1st Cross, Snehanagar,  
Amruthahalli Main Road, Bangalore-92.

**PROJECT :** Proposed Construction of Retaining Wall near BIEC Location, Bangalore –  
Nelamangala Section of NH-4 from Km.10+000 to 29+500.

**Type of Drilling :** Manual Auguring method.

**BH NO :** 04 17+350 LHS

**GWL :** Not Encountered

Depth below EGL (M)	Soil Description	Thick-ness of Strata (m)	Legend	Details of Sampling		Standard Penetration Test Data		
				Depth (m)	Type	Depth (m)	"N" Value	Rel. density or consistency
0				0.00				
1	Filled Up (Asphalt and WMM layer)	1.50						
2				1.50	UDS			
3	Reddish Brown Silty sand with clay binder	3.00			SPT	2.0	7/8/8 N=16	
4					SPT	3.5	9/9/10 N=19	
5	Greyish Brown silty sand with clay binder	1.50		4.50				
6					SPT	5.5	13/15/15 N=30	
7				6.00				

Bore hole is terminated at 6.0m from the Existing ground level.

EGL - Existing Ground Level

GWL – Ground water level

UDS - Undisturbed sample

SPT - Standard Penetration Test

DS - Disturbed sample

\* - Sample not retrieved.

**DESIGN OF FOUNDATION FOR BOREHOLE 1**

(According to I S 6403:1981)

**AT DEPTH 1.5m**

$$q_a = \frac{C^2 N^2 c S d c i c + \gamma D_f (N^2 q - 1) S q d q i q + 0.5 B \gamma N^2 \gamma S y d y i y W}{FS} + \gamma D_f$$

$q_a$  = Safe Bearing Capacity in T/m<sup>2</sup>,  
 FS = Factor of Safety - 2.50  
 $B_f$  = Width of Foundation - 1.00m  
 $D_f$  = Depth of Foundation - 4.75m As furnished by the customer  
 $W'$  = Correction Factor for Water table = 1.00  
 $W''$  = Correction Factor for Water table = 1.00  
 $C = 0.60$  T/m<sup>2</sup>,  $C = 0.40$  T/m<sup>2</sup>,  $\phi = 25^\circ$ ,  $\phi = 17^\circ$ ,  $\gamma = 1.69$ g/cc  
 $N_c = 12.520$   $N_q = 4.924$   $N = 3.746$   $W' = 1.00$   
 $S_c = 1.00$   $S_q = 1.00$   $S = 1.00$   
 $i_c = 1.00$   $i_q = 1.00$   $i = 1.00$

$$d_c = 1 + 0.2 \frac{D}{B} \sqrt{N}$$

$$\sqrt{N} = \tan^2 (45 + \phi/2)$$

$$N = \tan^2 (45 + \phi/2)$$

$$d_c = 1 + 0.2 \frac{D}{B} \sqrt{N} = 1.06$$

$$d_q = d = 1 + 0.1 \frac{D}{B} \tan (45 + \phi/2) = 1.03$$

$$q_a = \frac{(0.40 \times 12.52 \times 1.0 \times 1.06 \times 1) + (1.69 \times 1.5 \times (4.924) \times 1.0 \times 1.03 \times 1) + (0.5 \times 4.75 \times 1.69 \times 3.746 \times 1.0 \times 1.03 \times 1 \times 1.00) + \{(1.69 \times 1.0)\}}{(2.50)}$$

$$q_a = 14.00 \text{ T/m}^2$$

#### AT DEPTH 3m

$$q_a = \frac{C' N' c S_c d_c i_c + \gamma D_f (N' q - 1) S_q d_q i_q + 0.5 B \gamma N' \gamma S_y d_y i_y W' + \gamma D_f}{FS}$$

$$q_a = 16.00 \text{ T/m}^2$$

### DESIGN OF FOUNDATION FOR BOREHOLE 2

(According to I S 6403:1981)

#### AT DEPTH 1.5m

$$q_a = \frac{C' N' c S_c d_c i_c + \gamma D_f (N' q - 1) S_q d_q i_q + 0.5 B \gamma N' \gamma S_y d_y i_y W' + \gamma D_f}{FS}$$

$$q_a = \frac{(0.40 \times 12.52 \times 1.0 \times 1.06 \times 1) + (1.69 \times 1.5 \times (4.924) \times 1.0 \times 1.03 \times 1) + (0.5 \times 4.75 \times 1.69 \times 3.746 \times 1.0 \times 1.03 \times 1 \times 1.00) + \{(1.69 \times 1.0)\}}{(2.50)}$$

$$q_a = 13.00 \text{ T/m}^2$$

#### SETTLEMENT AS PER IS: 8009 (Part I) for Strip footing

For  $N=15$ ,  $B=1.5$ m

As per Fig.9 of IS: 8009 (Part I)

Settlement =  $1.70 \times 10^{-3}$ (m)  $\times 1.3 \times 100 \times 10 = 22.1$ mm < 25mm

Hence adopt SBC = 13.00 T/m<sup>2</sup>

#### AT DEPTH 3m

$$q_a = \frac{C' N' c S_c d_c i_c + \gamma D_f (N' q - 1) S_q d_q i_q + 0.5 B \gamma N' \gamma S_y d_y i_y W' + \gamma D_f}{FS}$$

$$q_a = 16.00 \text{ T/m}^2$$

### DESIGN OF FOUNDATION FOR BOREHOLE 3

(According to I S 6403:1981)

AT DEPTH 1.5m

$$q_a = \frac{C'N'cScdcic + \gamma Df(N'q-1)Sqdqiq + 0.5B\gamma N'\gamma S\gamma d\gamma iyW}{FS} + \gamma Df$$

$$q_a = \frac{(0.40 \times 12.52 \times 1.0 \times 1.06 \times 1) + (1.69 \times 1.5 \times (4.9241) \times 1.0 \times 1.03 \times 1) + (0.5 \times 4.75 \times 1.69 \times 3.746 \times 1.0 \times 1.03 \times 1 \times 1.00) + \{(1.69 \times 1.0)\}}{(2.50)}$$

$$q_a = \underline{14.00} \text{ T/m}^2$$

AT DEPTH 3m

$$q_a = \frac{C'N'cScdcic + \gamma Df(N'q-1)Sqdqiq + 0.5B\gamma N'\gamma S\gamma d\gamma iyW}{FS} + \gamma Df$$

$$q_a = \underline{16.00} \text{ T/m}^2$$

#### DESIGN OF FOUNDATION FOR BOREHOLE 4

(According to I S 6403:1981)

AT DEPTH 1.5m

$$q_a = \frac{C'N'cScdcic + \gamma Df(N'q-1)Sqdqiq + 0.5B\gamma N'\gamma S\gamma d\gamma iyW}{FS} + \gamma Df$$

$$q_a = \frac{(0.40 \times 12.52 \times 1.0 \times 1.06 \times 1) + (1.69 \times 1.5 \times (4.9241) \times 1.0 \times 1.03 \times 1) + (0.5 \times 4.75 \times 1.69 \times 3.746 \times 1.0 \times 1.03 \times 1 \times 1.00) + \{(1.69 \times 1.0)\}}{(2.50)}$$

$$q_a = \underline{14.00} \text{ T/m}^2$$

AT DEPTH 3m

$$q_a = \frac{C'N'cScdcic + \gamma Df(N'q-1)Sqdqiq + 0.5B\gamma N'\gamma S\gamma d\gamma iyW}{FS} + \gamma Df$$

$$q_a = \underline{16.00} \text{ T/m}^2$$

IV. RECOMMANDATIONS

**BOREHOLE 1:-**

From the field and laboratory investigation, Gravel = 04 to 17%, Sand = 56 to 77%, Silt & Clay= 19 to 31%, Liquid Limit = 26 to 40% and the Plasticity Index= 8 to 16. The N value is 5 at 2.0m, 21 at 3.5m and 41 at 5.5m depth.

Depth below ground level(m)	SBC in T/m <sup>2</sup>	Types of foundation suggested
1.5	14.0	Strip foundation
3.0	16.0	

The Safe Bearing Capacity values at different depths are given below.

**Table no 3.8: - Recommendation on Borehole 1**

**BOREHOLE 2: -**

From the field and laboratory investigation, Gravel = 0 to 5%, Sand = 40 to 77%, Silt & Clay=23 to 55%, Liquid Limit = 30 to 32% and the Plasticity Index= 10 to 12. The N Value is 15 at 2.0m, 19 at 3.5m and 34 at 5.5m depth.

The Safe Bearing Capacity values at different depths are given below.

**Table no 3.9: - Recommendation on Borehole 2**

Depth below ground level(m)	SBC in T/m <sup>2</sup>	Types of foundation suggested
1.5	13.0	Strip foundation
3.0	16.0	

**BOREHOLE 3: -**

From the field and laboratory investigation, Gravel = 4 to 32%, Sand = 53 to 68%, Silt & Clay=15 to 35%, Liquid Limit = 24 to 44% and the Plasticity Index= 12 to 14 up to 4.5m and Non plastic at 5.0m. The N Value is 11 at 2.0m, 17 at 3.5m and 95 at 5.5m depth

The Safe Bearing Capacity values at different depths are given below.

**Table no 3.10: - Recommendation on Borehole 3**

Depth below ground level(m)	SBC in T/m <sup>2</sup>	Types of foundation suggested
1.5	14.0	Strip foundation
3.0	16.0	

**BOREHOLE 4 :-**

From the field and laboratory investigation, Gravel = 1 to 16%, Sand = 59 to 66%, Silt & Clay=25 to 31%, Liquid Limit = 28 to 30% and the Plasticity Index= 8 to 10. The N Value is 16 at 2.0m, 19 at 3.5m and 30 at 5.5m depth.

The Safe Bearing Capacity values at different depths are given below.

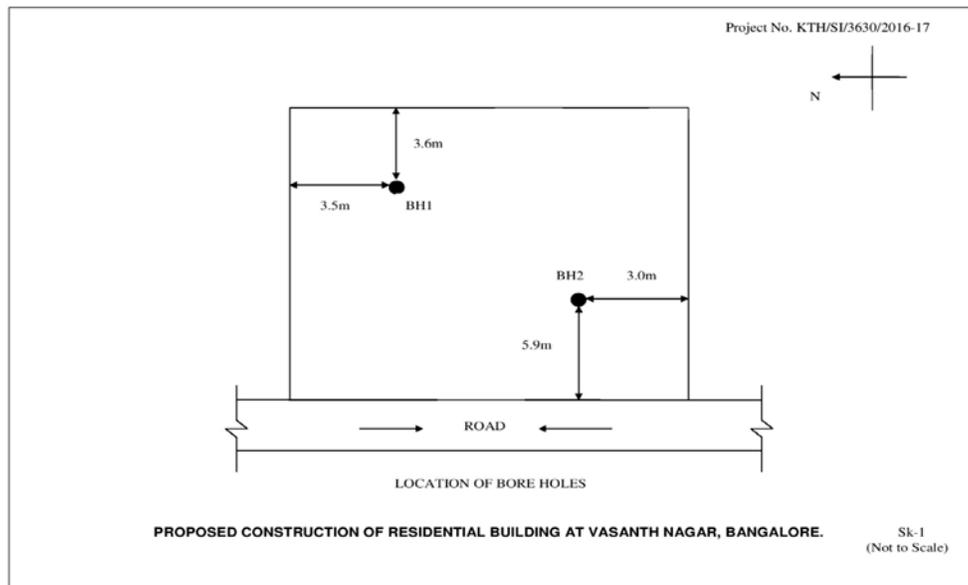
**Table no 3.11: - Recommendation on Borehole 4**

Depth below ground level(m)	SBC in T/m <sup>2</sup>	Types of foundation suggested
1.5	14.0	Strip foundation
3.0	16.0	

**PROJECT 2**

**Name of the project: -**

Proposed construction of residential building at vasanth nagar, Bangalore.



**Fig 3.2:- Site location plan**

Soil samples obtained: -

Disturbed and undisturbed soil samples are obtained in the field.

- TEST REPORTS ON SOIL SAMPLES: - **SIEVE ANALYSIS BORE HOLE 1**

**Table no 3.12: - Results on sieve analysis of Borehole 1**

BH. No.	Depth in m	Gravel in %	Sand in %			Silt and clay in %	Liquid limit in %	Plastic limit in %	Plasticity index
			C	M	F				
1	2.0	01	09	27	23	40	24	NP	NIL
1	3.5	05	13	27	20	35	28	18	10
1	5.5	-	02	32	22	44	24	NP	NIL

**SOIL CLASSIFICATION (IS : 1498– 1970):- SILTY SAND AT DEPTH 2m & 5.5m, SILTY SAND WITH CLAY BINDER AT DEPTH 3.5m**

**BORE HOLE 2**

**Table no 3.13: - Results on sieve analysis of Borehole 2**

BH. No.	Depth in m	Gravel in %	Sand in %			Silt and clay in %	Liquid limit in %	Plastic limit in %	Plasticity index
			C	M	F				
2	2.0	-	15	35	22	28	28	20	08
2	3.5	05	17	39	16	23	28	NP	NIL
2	5.5	06	19	26	17	32	26	NP	NIL

**SOIL CLASSIFICATION (IS : 1498– 1970):- SILTY SAND WITH CLAY BINDER AT DEPTH 2M & 5.5M, SILTY SAND AT DEPTH 3.5m**

**DIRECT SHEAR: -**

Table no 3.14: - Results on Direct shear test of Borehole 1	
Normal stress in kg/cm <sup>2</sup>	Shear stress in kg/cm <sup>2</sup>
0.5	0.65
1.0	1.2
1.5	1.7

**Table no 3.15: - C and  $\phi$  values**

BH No	Depth in m	C T/m <sup>2</sup>	$\phi$
1	1.5	0.50	29
2	1.5	0.40	30

**COMPACTION TEST**

**Table no 3.16: - Results on Compaction test of Borehole 1 to Borehole 2**

BH. No.	Depth in m	Field Moisture Content %	<sup>b</sup> kg/m <sup>3</sup>	<sup>d</sup> kg/m <sup>3</sup>	Optimum Moisture content %	Maximum dry density kg/m <sup>3</sup>
1	1.5	4.62	1.69	1.62	12	1.87
2	1.5	8.45	1.79	1.65	12	1.85

**BORELOGS**



**KARNATAKA TEST HOUSE PVT. LTD.**  
NABL Accredited Laboratory as per ISO/IEC 17025

**B O R E L O G**

Project No/KTH/SI/3629/2016-17

**CLIENT :** M/s. Rachana Consultants.,  
#619/D, 3<sup>rd</sup> Floor, 36<sup>th</sup> Cross,  
2<sup>nd</sup> Block, Rajajinagar,  
Bangalore-10.

**PROJECT :** Proposed Construction of Residential Building at Vasanth Nagar,  
Bangalore.

**Type of Drilling :** Manual Auguring method

**BH NO :** 01 **GWL :** Encountered at 2.25m from EGL

Depth below EGL (M)	Soil Description	Thick-ness of Strata (m)	Legend	Details of Sampling		Standard Penetration Test Data		
				Depth (m)	Type	Depth (m)	"N" Value	Rel. density or consistency
0								
1	Whitish Yellow Silty sand	3.5		1.5	UDS			
2				SPT	2.0	8/10/13		
						2.25	N=23	
3				3.5	SPT	3.5	10/10/14	
4	Whitish Grey Silty sand with clay binder	2.0					N=24	
5								
	Whitish Grey Silty sand	0.5		5.5	SPT	5.5	10/11/11	
6								
7				6.0				

Bore hole is terminated at 6.0m from the Existing ground level.  
EGL - Existing Ground Level  
UDS - Undisturbed sample  
DS - Disturbed sample  
GWL - Ground water level  
SPT - Standard Penetration Test  
\* - Sample not retrieved.



**KARNATAKA TEST HOUSE PVT. LTD.**  
NABL Accredited Laboratory as per ISO/IEC 17025

**B O R E L O G**

Project No/KTH/SI/3629/2016-17

**CLIENT** : **M/s. Rachana Consultants.,**  
#619/D, 3<sup>rd</sup> Floor, 36<sup>th</sup> Cross,  
2<sup>nd</sup> Block, Rajajinagar,  
Bangalore-10.

**PROJECT** : Proposed Construction of Residential Building at Vasanth Nagar,  
Bangalore.

**Type of Drilling** : Manual Auguring method

**BH NO** : **02** **GWL** : Encountered at 2.5m from EGL

Depth below EGL (M)	Soil Description	Thick-ness of Strata (m)	Legend	Details of Sampling		Standard Penetration Test Data		
				Depth (m)	Type	Depth (m)	"N" Value	Rel. density or consistency
0								
1	Whitish Yellow Silty sand with clay binder	3.5		1.5	UDS			
2				SPT	2.0	15/15/17 N=32		
3			3.5	SPT	3.5	17/17/17 N=34		
4	Whitish Grey Silty sand	2.5						
5				SPT	5.5	27/60 at 10cm penetration (N>100) Refusal		
6				6.0				
7								

Bore hole is terminated at 6.0m from the Existing ground level.

EGL - Existing Ground Level

UDS - Undisturbed sample

DS - Disturbed sample

GWL - Ground water level

SPT - Standard Penetration Test

\* - Sample not retrieved.

**DESIGN OF FOUNDATION FOR BORE HOLE 1 and 2**

(According to I S 6403:1981)

**AT DEPTH 1.5m**

$$q_a = \frac{C^* N^* c_s c_{dc} + \gamma D_f (N^* q - 1) S_q d q_i q + 0.5 B \gamma N^* \gamma_s \gamma_{dy} \gamma W}{FS} + \gamma D_f$$

$q_a$  = Safe Bearing Capacity in T/m<sup>2</sup>,  
 FS = Factor of Safety - 2.50  
 Bf = Width of Foundation - 1.50m  
 Df = Depth of Foundation - 1.50m,  
 W. = Correction Factor for Water table = 1.0  
 $C = 0.50$  T/m<sup>2</sup>,  $C_{\phi} = 0.34$  T/m<sup>2</sup>,  $\phi = 29^\circ$ ,  $\phi_{\phi} = 20^\circ$ ,  $\phi_{\phi} = 1.62$ T/m<sup>3</sup>  
 $N_{\phi} c = 14830$   $N_{\phi} q = 6.4$   $N_{\phi \phi} = 5.39$   $W = 1.0$   
 $S_c = 1.30$   $S_q = 1.2$   $S_{\phi} = 0.8$   
 $i_c = 1.00$   $i_q = 1.00$   $i_{\phi} = 1.00$

$$d_c = 1 + 0.2 \frac{D}{B} \sqrt{N_{\phi}}$$

$$\sqrt{N_{\phi}} = \tan^2 (3.14/4 + \phi/2)$$

$$N_{\phi} = \tan (45 + \phi/2)$$

$$d_c = 1 + 0.2 \frac{D}{B} \sqrt{N_{\phi}} = 1.34$$

$$d_q = d_{\phi} = 1 + 0.1 D \tan (45 + \phi/2) = 1.17$$

$$q_a = \frac{0.34 \times 14.830 \times 1.3 \times 1.34 \times 1 + (1.62 \times 1.5 \times (6.4 - 1) \times 1.2 \times 1.17 \times 0.5) + (0.5 \times 1.5 \times 1.62 \times 5.39 \times 0.8 \times 1.17 \times 1 \times 1)}{2.50 + (1.62 \times 1.5)}$$

$$q_a = 16.00 \text{ T/m}^2$$

**SETTLEMENT AS PER IS: 8009 (Part I) for Isolated footing**

For N=23, B=1.5m

As per Fig.9 of IS: 8009 (Part I)

$$\text{Settlement} = 1.0 \times 10^{-2} (\text{m}) \times 1.6 \times 100 \times 10$$

$$= 16.64 \text{ mm} < 25 \text{ mm}$$

Hence adopt SBC= **16.00 T/m<sup>2</sup>**

**AT DEPTH 3.0m**

$$q_a = \frac{C' N' c S_c d_c i_c + \gamma D_f (N' q - 1) S_q d_q i_q + 0.5 B \gamma N' \gamma S_y d_y i_y W + \gamma D_f}{FS}$$

$$q_a = 18.00 \text{ T/m}^2$$

**RECOMMENDATIONS**

**BOREHOLE 1 and 2: -**

From the field and laboratory investigation, the subsoil consists of medium dense Whitish Yellow Silty sand followed by Whitish Grey Silty sand with clay binder having Gravel = 0 to 06%, Sand = 56 to 72%, Silt & Clay= 23 to 44%, Liquid Limit = 24 to 28% and the Plasticity Index= NP to 10 in BH1, 08 to non-plastic in BH2. The N values ranges from 23 to 22 in BH1, 32 to 34 and more than 100 at 5.5m depth in BH2. Both the boreholes are terminated at 6.0m from the existing ground level.

Depth below ground level(m)	SBC in T/m <sup>2</sup>	Types of foundation suggested
1.5	16.0	Isolated Column Footing
3.0	18.0	

The Safe Bearing Capacity values at different depths are given below.

**Table no 3.17: - Recommendation on Borehole 1 and Borehole 2**

## V. CONCLUSION

On the whole, this internship programme was a useful experience which helped to gain new knowledge, skills and met many new people and got insight into professional practice and also learned the different facets of working within consultancy.

The field investigation helped to understand the physical observation and general survey of the site location and also different methods of sampling and subsurface explorations whereas laboratory investigation has enhanced expertise of different laboratory experiments as per I.S codes.

At the start of internship work in the company, was aware of only the theoretical knowledge of the works and some practical knowledge regarding laboratory experiments. It was really fascinating and inspiring to see and experience the lessons learnt been put to use in practice.

This opportunity will definitely be a big milestone in the career development and help to do better in the future endeavors. Gained skills and knowledge would be put to use in the best possible way, and would continue to work on their improvement, in order to attain desired career objectives and express more confidently.

Internship program brought me good theoretical and practical knowledge, also the good knowledge about the design and their implementation in or off the site.

At last this internship has given a new insights and motivations to pursue a career in geotechnical engineering in India or abroad.

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# Does SHG - Bank Linkage Programme Lead to the Women Empowerment

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**Abstract-** Women empowerment plays a vital role in the overall development of the society. In India various programmes and policies initiated by the government for the women empowerment and NABARD played an essential role in empowering women through the initiation of Self Help Groups and SHG-Bank linkage programmes and participation of women in SHGs created a considerable impact on their social as well as economic empowerment and brought a substantial change in the life of women at the fundamental level. The present paper is an attempt to analyze the contribution of Self help groups in women empowerment in India. As per the study the main reason behind the progress of Self Help Groups are: its credit linkage with poor and vulnerable people, it is very helpful in building up the financial status of its member households and above all, it has achieved success to develop the self dependence and confidence among poor and rural women which leads the development of the livelihood of the rural people especially women. Besides that the study also describes some of the constraints of women empowerment especially in rural areas and it is the utmost priority of the SHG programme and government to overcome the constraints to achieve inclusive growth through women empowerment

(Millennium project, 2015, Sahu & Singh, 2012). In India women empowerment is always a prime concern for the government, eighth, ninth, tenth, five plans of India are emerged with the priorities of women empowerment and development other than this Rashtriya Mahila Kosh also established to provide the economic help to the deprived women (Sinha, 2008) because women empowerment is very essential in rural areas and Self help group is doing its best efforts in improving socio economic position of women in the society. The condition of women in rural areas is not good because they lived their life in loneliness, even they cannot access the basic services but the establishment of Self help group is quite beneficial for the rural and poor women because it is helpful for the women to achieve the social and psychological motility in the society. (Yadav, 2010). SHG is the best way for the women empowerment and its impact upon women condition is quite remarkable which includes- economic sovereignty by increased level of income, increasing participation in households decisions which leads to the women's welfare (Yadav, 2010). Establishment of Self help groups under the movement of microfinance have brought remarkable transformation at the fundamental level by empowering women (Sahu & Singh, 2012).

SHGs are small groups which are established with the motive to provide the economic help to the poor and vulnerable people especially women which includes credit and saving facilities through mutual help and joint responsibility, SHG is a group based approach which facilitates the poor households to collect capital and also enables them to access the financial facilities. The basic motive of SHG is to reach the unreached or poor households specially women and empower them through credit and saving facilitation (Anand, 2002).

SHG is a best medium for the social and economic empowerment reason being it inculcates the habits of saving and banking among the members of the group. These informal groups of poor people having the objective to garner the economic help through mutual help and joint responsibility. SHG enables the group members to do small savings who are not able to do big savings. SHG creates the confidence and self dependence among the poor and rural people especially among the women who are ignored in the social composition (Anand, 2002).

**Index Terms-** SHG, SHG-BLP, NABARD, Empowerment

## I. INTRODUCTION

Human development is always a prime concern for the government of every country even NGOs are also focusing towards the human development in many ways. Development has various extents like socio economic development, political development but the process of development is curtailed without the development of women of a country reason being, over all community can be developed through the development of women because participation of women and contribution of women in the society is very essential for the societal development but the sad part is that, women are not considered to be a part of the development and that is badly effecting their lives (Vijayanthi, 2002). Women empowerment is a vital tool for alleviating poverty because women comprised half of the world's population but still they are ignored and excluded from the social and economic development (Sinha, 2008). To counter the issue of women development, the government of all over the world are working and ensuring that maximum efforts can take place in the field of women empowerment, In India as well a lot movements are running for the women empowerment even in the Millennium development goals women empowerment is one of the agendas

## II. SHG-BLP AND WOMEN EMPOWERMENT

In India SHGs and its linkage from the formal banking sector is the biggest promotion of Microfinance and it can be said that SHG is the fastest growing initiative of the microfinance programmes in India and it is doing exceptionally well in the

field of women empowerment instead of facing a lot of issues and limitations. Being an agricultural country in India female comprised an essential part of the labor force because most of the women are agriculture labor in rural areas and SHG tends to be the most effective way of women empowerment with having the objective of inculcating the habit of banking and saving in women and providing them alternative for credit so that they can be financial sustainable and this will encourage the confidence level of women to perform their responsibilities, to make it more worthy SHG- Bank linkage programme is a foremost programme which is providing financial services to the rural and vulnerable people specially for women (Suceena, 2016).

### 2.1 Progress of SHG Bank Linkage Programme

The Linkage between SHG and banks is an essential step towards conveying the financial services to the poor households. In 1992 a model was designed by NABARD within the partnership between SHGs, Banks and NGOs (Tripathi, 2013). SHG-BLP is a plan which is based upon the community and it is measured as the biggest programme of microfinance in terms of

overreach (Reddy & Malik, 2011). According to this model NABARD is united for the support to the banks in terms of refinance and promotion for SHG-BLP. There was a slow progress between 1993 to 1999 because only 32995 SHGs linked with the banks but after that the linkage programme has been growing speedily and specially since last eight years it was growing quickly from 5009994 in 2008 to 7697469 in 2015 (NABARD, 2015).

Besides that the amount of distributed loan has led to a progressive stage as in there is a continuous increment in average loans amount from 17,663 to 35,832 in the duration of 2008-2015. (Table-1) In spite of this, the growth of SHG-BLP designates decline in terms of linkage and loan amount as in the amount of outstanding loan in 2015 is 44,68,180 which represents the negative growth rate of 6.4% as compared to the growth rate of 2008 of 16.50%, correspondingly the amount of outstanding loan signify the rate of growth of 37% but it falls in 2015 by 20.07%.

**Table-1 Number of SHGs linked with banks and amount of loan distributed as on 31 March.**

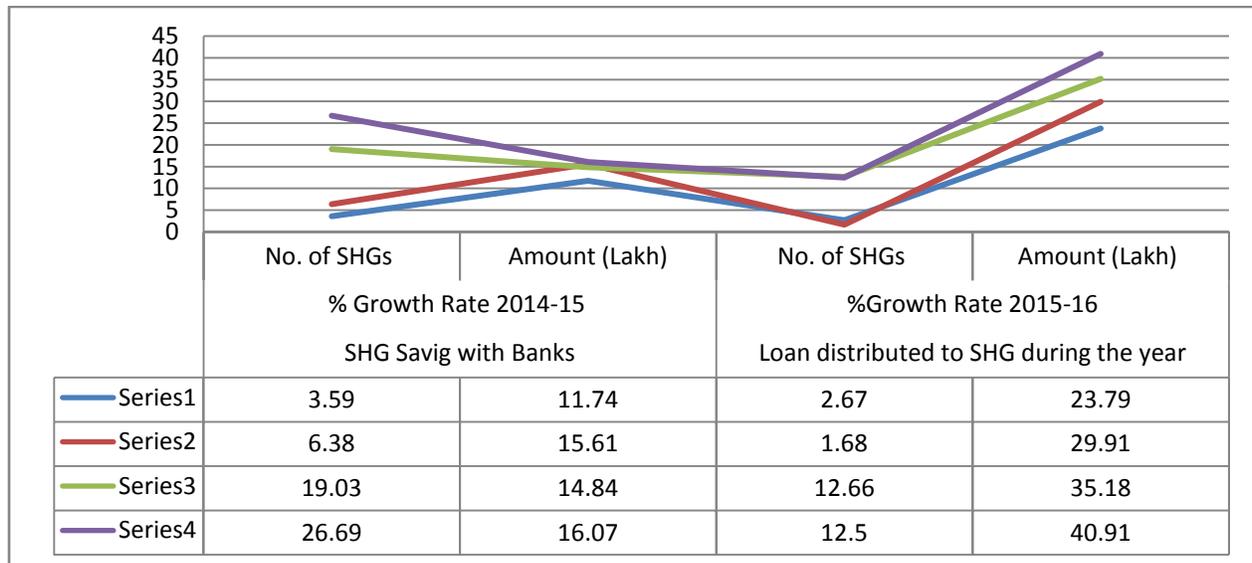
Year	SHG Avail Loan	Amount of loan	Amount of average loan
2008	1227770	884926.24	17663
2009	1609586	1225351.39	20018
2010	1586822	1445330.36	20786
2011	1196134	1454773.19	19495
2012	1147878	1653476.87	20771
2013	1219821	2058536.44	28131
2014	1366421	2401735.85	32327
2015	1626238	2758231.06	35832

Source: Status of Micro finance in India published by NABARD

During last three years there is a continuous improvement in the SHG-BLP programmes in India. In 2015-16 total no. of SHGs that are linked with banks are 79.03 lakh out of which 67.63 lakh tends to be the women SHGs and percentage of women group is also increased to 87.91% in 2016, total No. of SHGs that are distributed loan during the last year is also increased in past three years from 13.66% in 2013-14 to 18.32% in 2015-16 out of which 16.29% of SHGs are belongs to women,

other than that the amount of loan distributed by the total no. of SHGs is 37286.9 crore in 2016 out of which 34411.42 crore loan distributed to women SHGs, percentage of women group has also increased to 93% in 2016 from 84.3% in 2013-2014. Other than that the percentage of women SHGs also shows improvement in 2015-16 with 90.04% for last three years.

**Figure-1 Progress of Women’s Self Help Group**



Source: Status of Micro finance in India published by NABARD

With this it is quite clear that the ratio of women SHGs are continuously increasing in SHG-BLP programme and the major reason behind this progress is the trust and faith of rural and poor women on the SHG programme and its credit linkages because SHG programmes supported those rural and poor women who are ignored by the formal banking sector, other than this SHG programmes are also trying to redevelop the faith of their client in the formal banking sector through its linkage programme of SHG-BLP.

### III. IMPACT OF SHG-BLP ON WOMEN EMPOWERMENT

There are certain indicators are there through which we can measured the women empowerment like: women’s who are the clients of SHG linkage programme had contributed 30% in total savings of the households while on the other side non client women had a low share of 28% in total savings, specially the women’s who belongs to the very poor class recorded the growth of 80% in their share in total savings of the household, SHG-BLP is quite helpful in transforming the life of poor and vulnerable women by providing them the credit and saving facilities which are very helpful to increase their income because with the support of linkage programme women can start their own work or small business like grocery store, teat shop, dairy etc. with this progress several women clients of SHG-BLP turned in to the successful entrepreneurs, SHG-BLP is also working for the development of the individual growth of a women by creating awareness about the programme, to give them a chance to be a leader in SHG-BLP programme which is quite beneficial in raising their confidence level, SHG-BLP also empowered women at household level because after the participation in linkage programme the joint ownership of the assets of women with men has perked up to 37% and the individual ownership of women in assets also been increased by 1% and reached at 27%, SHG-BLP is very helpful in the development of women enterprises because SHG-BLP is providing the ample support in the form of micro

credit to the women to establish or develop their own small enterprise and southern region is recorded that 47% women are involved in enterprise management. SHG-BLP is providing the support to the poor and needy women to increase their level of income and contribute in their family income and with this women are also taking part in family decision making.

### IV. NABARD INITIATIVE TO PROMOTE SHG AND CREDIT LINKAGE IN BACKWARD AREAS FOR RURAL AND POOR WOMEN

To promote SHG scheme regarding women in backward districts NABARD initiated the economic support to the NGOs (the promoting agency of SHG) till 31 March 2016, the 20498.10 lakh amount sanctioned to 204981 SHGs but 5611.43 lakh amount availed or released to 188254 SHGs till 31 March 2016. Through this move NABARD is extending and promoting SHGs and SHG-BLP in the rural areas and backward areas so that the rural and vulnerable women make the most of the scheme and indulge themselves in to this scheme to enhance their Income generating activities and raise their living of standards.

NABARD is continuously doing efforts in this scheme for the backward districts in India in association with the Department of Financial Services of India and implement that scheme of SHG in the 150 backward districts in India so that the rural women can reap the benefits of the SHG programmes. The promoting agency of SHGs which means NGOs are not only working upon the promotion of SHG and credit linkages but they are also focusing on the outreach of banking sector to the rural areas, they also monitor the SHG working process and concentrate the repayment of loan to the banks by SHGs.

NABARD also launched LEDP, Livelihood Entrepreneurship Development Programme in December 2015 with the motive of livelihood promotion and uplifting the SHG members through various programmes of skill up gradation. The LEDP implemented in small groups for 150 SHG members in a

cluster of a village, LEDP focused towards the agriculture activities, allied activities and nonfarm activities which belongs to the rural areas (Status of Microfinance in India, NABARD, 2016)

#### V. CONSTRAINTS ON THE EMPOWERMENT OF WOMEN

There are several schemes and budget announced by the government for the women empowerment but still we cannot achieve the desired outcomes because of women's motility and if we really want to see the change in the condition of women than we must do something to change the women's motility, communal interface, than only we can see the true picture of women empowerment, other than this we try to change the women education system, their control over decision making in their families, we must providing support for their self employment and establishing SHG, to fulfill their needs of proper housing, health, nutrition but above all the community should change its view towards the women and persuade them for their development (Succena, 2016).

SHGs recorded a great success in the empowerment of rural people and especially for empowering women in rural areas and government also supported this programme of microfinance by its policies and schemes but still the women SHGs are dealing with some issues which are creating hindrance in women empowerment like: generally women are very restricted in their family regarding financial independence and because of that women are mostly fail to repay their collateral and that is the major reason behind the unwillingness of Banks to provide financial services to these SHGs, patricentric approach of the society is also one of the reasons behind the doubt on the women SHGs, the issue of literacy is also like a constraint of women empowerment reason being literacy level are generally low in the rural areas and especially in rural women and this will create hindrance in the progress of women SHGs (Savitha, Rajshekhar, 2014), rural women generally do not have any knowledge regarding the women right and that is hammering their empowerment.

#### VI. CONCLUSION AND POLICY SUGGESTIONS

Everyone needs finance as it is necessary for the socio and economic development of the rural and poor people especially for women and Self help group programmes has the positive impact on women empowerment because it has observed that women SHG members reported high score of women empowerment rather than the non participants because participation in the SHG programmes engross women in household action. Being a group member of SHG women needs to attend the group meeting time to time, they also need to be attend the meetings with the banking professionals for the linkage programmes other than this SHG also organized various training programmes for women by which they gain confidence and self dependence and also understand his position and rights in her family. SHG is working efficiently for empowering women, SHG transformed the status of women in the social composition but that is not enough to attain complete women empowerment. To achieve the highest note, women's itself needs

to understand their priorities, their right and values in the society only than women empowerment can take place. SHG create groundwork for the self dependence through institutions so that employment opportunity can be produced for the rural and poor people especially for women. Other than this government should also initiate some plans for empowering women like: entrepreneurship programmes for the women should developed by the government, providing financial services to the women entrepreneur at low interest rates, upgrading the education for women in rural and backward areas but only the initiation of government programme is not enough, community or society should erase the gender discrimination and develop a sense of equality for the uplifting women (Succena).

As Kofi Annan said, "There is no tool for development more effective than the empowerment of women."

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# Sustainable Options for Reducing the Waste Footprint in Urban Residential Areas

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**Abstract-** Due to rapid urbanization and industrialization, urban areas all over the world, are subjected to various problems like rampant drinking water shortage, traffic congestions, rising level of noise and air pollution, solid waste management issues etc. Among this, solid waste management is the most threatening one. The residential wastes constitute the lion's share of urban solid waste. Changing lifestyles will pose special waste management challenges, as waste management systems in the urban areas of developing countries are incapable of frequent adjustment to match these lifestyle changes. The difficulty has been aggravated by lack of effective legislation, inadequate funds and services, and inability of municipal authorities to provide the services cost-efficiently. This paper attempts to figure out various sustainable options to reduce the waste management issues in the urban residential areas through the waste footprint concept, which is a subset of ecological footprint in the environment management tool- ecological footprint analysis.

**Index Terms-** Sustainable options, solid waste management, ecological footprint analysis, waste footprint, urban residential areas, Kochi city.

## I. INTRODUCTION

Everybody, who consumes the products and services of nature, makes an impact on the earth. According to the Living Planet Report 2012, during the last thirty years, consumption of natural resources has increased 40%, while earth's natural wealth in biodiversity has decreased 30%. In the next decade, we will be living in a riskier world with more people, more consumption, more waste and more poverty, but with less forest area, less available fresh water, less soil and less stratospheric ozone layer (Ravi and Subha, 2011). The situation will be more serious in the cities, since they are the 'engines of economic growth' (Vliet, 2002).

Increasing population levels, booming economy, rapid urbanization and the rise in community standards have greatly accelerated the municipal waste generation rate in developing countries (Minghua et al., 2009). Due to rapid population growth, changing lifestyles, food habits and living standards, the present pattern of the almost all the urban areas can be classified as that of haphazard growth with typical problems of unplanned urban development like water pollution, improper solid waste management, traffic congestion, slum development etc (Ravi and Subha, 2013). Of this, solid waste management is the most threatening one.

When solid waste is disposed off on land in open dumps or in improperly designed landfills (e.g. in low lying areas), it causes the impact on the environment like ground water contamination by the leachate generated by the waste dump; surface water contamination by the run-off from the waste dump; bad odour, pests, rodents and wind-blown litter in and around the waste dump; generation of inflammable gas (e.g. methane) within the waste dump; bird menace above the waste dump which affects flight of aircraft; fires within the waste dump; erosion and stability problems relating to slopes of the waste dump; epidemics through stray animals; acidity to surrounding soil and release of greenhouse gas etc (Malik and Grohmann, 2011). Hence, solid waste management (SWM) is one of the basic essential services to be provided by municipal authorities.

Management of solid waste is associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations (Siddiqui et.al, 2013). Municipalities, usually responsible for waste management in the cities, have the challenge to provide an effective and efficient system to the inhabitants (Vij, 2012). However, they often face problems beyond the ability of the municipal authority to tackle (Sujauddin et al., 2008) mainly due to lack of organization, financial resources, complexity and system multi dimensionality (Burntley, 2007).

This paper analyses the various options for sustainable solid waste management in the urban residential areas through the waste footprint case study in the residential areas of Kochi city, Kerala, India.

## II. CONCEPT OF WASTE FOOTPRINT

In earlier days, municipal wastes, comprised mainly of biodegradable matter which was either recycled/reused directly as manure or was within the assimilative capacity of the local environment (Puthillath & Sasikumar, 2015). Hence solid waste management was not a major issue in the past. The biodegradable wastes of the urban centres were accepted by the suburban rural areas for bio composting in the agricultural areas. With increasing content of plastics and non-biodegradable packaging materials, municipal wastes became increasingly offensive to the farmers and cultivators. As a result, the excessive accumulation of solid wastes in the urban environment poses serious threat not only to the urban areas but also to the rural areas (Kadam et. al, 2014).

Now, dealing with waste, is a major challenge in many of the local bodies or government. There are two aspects to the challenge, the social mind set and technology application (Varma, 2007). The social mind set is a very important aspect to be considered in this challenge. People are not aware of the quantity of waste generation from their own houses and work places, nor do they realize that the residential wastes are a major threat to waste management in the city. They believe that waste disposal is the responsibility of the government. But, the actual problem settles or comes under control when we consider how wastes are generated and how they are disposed. This requires awareness among the public about the waste generation and disposal methods. To provide a qualitative environment and atmosphere and to maintain the aesthetics and heritage of urban areas, a quantitative approach for waste management is to be applied. The amount of waste generation and their impact on the environment shall be calculated by individuals, households, enterprises etc. This shall be compared with the biocapacity of the area in which we live to assimilate the per capita waste generation. The waste footprinting technique is such a quantitative tool which can assess the individual impact of earth due to the waste generation.

Ecological footprint of waste generation or waste footprint means the measurement of biologically productive land (fossil, energy land, forest land, pasture land, built up area etc.) to assimilate the generated waste (Wackernagel et al., 2006). The ecological footprint of waste generation provides per capita land requirements for waste generation. By calculating the waste footprint, the local authorities can determine the land required to assimilate the waste generated in present and future, selection of disposal site and disposal site characteristics, the land fill site design and the importance of recycling of different waste categories in order to reduce the footprint (Salequzzaman et al., 2006).

### III. THE STUDY AREA – KOCHI CITY

The study area – Kochi city (formerly known as Cochin), lies between 9°48' and 10°50' latitude and 76°5' and 76°58'E longitude, Kerala, South India. It is the commercial capital of Kerala, 'The God's Own Country' and is in the Ernakulam district of Kerala. The Kochi Municipal Corporation extends to an area of 94.88 sq.km. As per census of India 2001, the population of Kochi Corporation is 5,95,575 and as per census 2011 the population is 6,01,574. The density of the city is 6,340 persons per sq. km against a density of 819 persons per sq. km in Kerala, 382 persons per sq. km in India and a world average of 46 persons per sq. km in 2011 (Census, 2011). The city is known as the 'Queen of Arabian Sea' which has attracted many voyagers and traders over the centuries especially the Greeks, Romans, Arabs, Chinese etc. Portuguese, Dutch and English came here and established colonies in the city which assimilated the cultures of many communities from all over the globe.

Kochi city region (KCR), constitutes an area of 366.91sq.km, it includes Kochi Corporation (Kochi city) and 9 municipalities 14 panchayats and parts of 4 panchayats. The region produces about 670 tons of solid waste per day. The contribution of Kochi city to the KCR alone is nearly 300T (CoK, 2010). The solid waste in Kochi Corporation is generated from a variety of sources, ranging from residential, to commercial establishments, public and institutional areas (CoK, 2010). 66% of the wastes are generated by the households in the city, 21% of waste by the commercial establishments, 4% by road sweeping, 3 % by institutions, and the rest 2% each by drain sweeping, clinical and construction and demolition wastes. This shows that the residential areas of the city are contributing the lion's share of Kochi's solid waste. As per the solid waste generation studies (KSUDP, 2007), the physical composition of municipal solid waste in Kochi city shows that organic wastes contribute to the maximum (79.78%) followed by paper (4.87%) and plastic wastes (4.83%). The composition of metal waste is comparatively low (0.35%).

The main issues identified in Kochi city related to solid waste management are poor level of waste collection; no segregation at source; no planned recycle/reuse; poor frequency of waste collection; inefficient collection and disposal at temporary transfer locations; obsolete waste handling and transportation system; inadequate street cleaning arrangement; water logging due to choking of drains with waste; mosquito menace due to stagnation of water in drains; filling environment not congenial to a tourists destination; misery to the poor who are the worst affected due to poor waste management; no shared vision for solid waste management etc.

The improper solid waste management in the city is identified as the root cause of many problems like pollution, outbreak of diseases, nuisance and other urban problems in the city (CoK, 2010). Also the organic waste from residential areas constitutes the major share (79.78%) of the municipal solid waste in Kochi city. If unattended, this will be a real threat to the city which will affect the serene nature of the city, social and economic development. This focus to the waste footprint study of Kochi city.

### IV. METHODOLOGY

To study the waste footprint of the city, a household survey was conducted during the period 2010-2013. Five hundred representative random samples (households) were selected from the residential areas of Kochi Corporation and outskirts, based on various criteria such as: low and high density areas within the corporation boundary and outskirts, away/near the CBD/MTN(CBD-Central Business District, MTN-Major Transportation Node), the modes of waste disposal, type of housing unit and the ownership of the buildings.

The survey was carried out with a participatory research (Pretty and Ward, 2001) using a structured questionnaire, which contains questions concerning the socio economic profile of the households, quantity of waste generation of each category of waste, type of waste disposal etc. The objective of the questionnaire was to analyze the variation in waste footprint values depending on the socio economic profile of the people, quantity of waste generation and the type of waste.

The survey was conducted in three seasons namely dry season (April, December - January), wet season (July) and festival season (August) with respect to the state of Kerala. These three seasons were selected to study and analyse the seasonal variations in

the footprint values in the city. The year 2010 was taken as the base year of this study. For tracking the waste generation and the recycling methods in the residences, survey was repeated in three consecutive years 2011 to 2013, in houses selected from already surveyed houses (2010 data) based on people's whole hearted support, involvement and co-operation in the research. The households were requested to segregate the wastes generated per day and to store for one day. The wastes generated were categorized into paper, glass, plastic, metal and organic waste (mainly food waste). The amount of paper waste was indirectly taken from the data of periodicals in the houses. The amount of glass and metal waste generated in a week was taken in account. The quantity of hazardous waste and e-waste was of negligible value in the residential while the survey was conducted. So the quantity of these wastes was not taken into account during the field study.

In calculating the waste footprint, the methodology/equations to assess the household ecological footprint of waste (Wackernagel et al., 2006) were used. The methodology utilizes the waste generation categories and the land use categories for those consumption and waste generation. The land use categories considered for waste footprint equations are energy land, forest land and built up land (Salequzzaman et al., 2006). Based on the equations, the waste footprint of each component of waste and the waste footprint analysis of Kochi city is carried out to quantify the impact of solid waste generation in Kochi city.

Software in a visual basic platform was developed (based on the above said equations) for the data entry and calculations, and the footprint values are estimated. The software was named the waste footprint analyser and the analyser generates the footprint value in hectares per capita and the programme is executed to get the waste footprint of the residents of the city.

In order to statistically analyze the data regarding waste footprint calculations dependent and independent variables were identified from the survey data. The statistical analysis of the waste footprint values for the dependent variables with respect to the independent variables has been done separately for the four consecutive years (2010 – 2013). The combined analysis of variations of the dependent and independent variables over the years were also carried out. For the year wise analysis of each category of wastes and footprint values (dependent variables) with respect to independent variables, ANOVA analysis was carried out for each year (2010-2013). To analyse the variations in quantity of wastes and footprint values with respect to the independent variables over the years, homogeneity of error variance across all years were tested for significance, by doing Bartlett's chi-square test (Gomez et al., 1984) for each variable. The test results showed that, except for a very few cases the error variances were homogenous. Therefore, the pooled analysis (Gomez et al., 1984) of variance was conducted across the years, to test if the variable was significant over the years and whether the interaction between year and the variable was significant.

For arriving at the sustainable waste management options for Kochi city, the analysis based on different recycling levels, different waste generation levels and combination of different recycling level and waste generation level were studied and examined in detail. The different recycling levels taken for the study falls under the head; present recycling; targeted recycling; and projected recycling. The different waste generation levels include; present generation; targeted reduction; and projected reduction.

The 'present recycling' meant the recycling rate that was observed during the time of primary survey conducted (2010) for the waste footprint studies in Kochi city. Since, less than 15% samples reported recycling of wastes, it is assumed that the 0% of waste is recycled. The 'present waste generation' refers to the waste generation status of each component of waste during the primary survey. During the primary survey, surveys conducted in the consecutive years (2010 -2013) and based on other secondary surveys such as interviews and discussions with local body officials, department officials, NGOs and other organizations; it was observed that many recycling initiatives are in the pipeline and at the anvil, which may get launched in the residential areas of the city and outskirts. The 'targeted recycling' values are meant in this regard. The 'targeted waste reduction' means the waste reduction level that can be attained after the targeted recycling or a shift in the waste generation habits of the people. The 'projected recycling' rate is assumed considering the maximum recycling levels practiced in other urban areas over the world, that can reduce the waste footprint to considerable levels. 'Projected waste reduction' is the maximum waste reduction that can be achieved at the optimistic level.

## V. RESULTS AND DISCUSSIONS

### A. Waste Footprint and Land Requirements for the Assimilation of Generated Waste in the City

The waste generation in the residential areas of Kochi city as on 2013 is 0.51kg/capita/day with an average household size 3.72. Based on the trend analysis, this may be projected to 0.58kg/capita/day in 2020. On an average the organic waste constitutes about 80.1%, metal waste 10.5%, glass waste 5.1%, paper waste 2.6 % and plastic waste 1.9% of the total waste. In order to assimilate these wastes, an area of 0.013 hectare per capita is required in the dry seasons, 0.016 hectare per capita for the festival season and 0.015 hectare per capita for the wet seasons. An average of 132.04 m<sup>2</sup> per capita of energy land, 0.08 m<sup>2</sup> per capita of forest land and 16.47 m<sup>2</sup> per capita of built up land is required to assimilate the waste generated by the residents of Kochi city. The temporal variations of the waste footprint of the residential areas of Kochi city shows that, the waste footprint has been increasing from 0.0129 hectares per capita in 2010 to 0.0163 hectares per capita in 2013. This accounts for 26.35% increase within 4 years. For all other wastes except for plastics and metals the percentage share of the footprint value is less than the percentage share of that waste in the total waste (Ravi and Subha,2016).

The analysis of ecological footprint of waste generation in the residential areas of Kochi city showed that, with the present trend of waste generation and a population growth rate of 4.5%, by 2051 the population will need about the full area of the city to assimilate the generated waste. This is shown in Table 5.1.

Table 5.1 Land Requirement for Waste Management of Kochi City Over the Decades

Year	Population	Waste footprint per person	Area (hectares) required for the total population
2001	595575	0.013	7674.6
2011	601574	0.013	7751.9
2021	628645	0.013	8100.7
2031	656934	0.013	8465.2
2041	686496	0.013	8846.2
<b>2051</b>	<b>717388</b>	0.013	<b>9244.3</b>
2061	749671	0.013	9660.3
2071	783406	0.013	10095.0
2081	818659	0.013	10549.2

*Projections are made up to the year 2081 in order to show the severity of the problem, such that by 2051 the entire city land area is required for assimilation of waste.*

## B. Sustainable Options to Reduce the Waste Footprint in the Residential Areas of Kochi City

### i. Analysis based on different recycling levels

The ‘present recycling’ level values for all categories of waste were assigned zero percentage (Column 2). By the initiatives mentioned in last paragraph of the methodology part, it is expected that 60% of paper waste, 30% of glass and metal waste, 75% of organic waste and 25% of the plastic wastes can be recycled (Column 3). At the high optimistic level, the projected recycling levels for paper, glass, metal, organic and plastic wastes are 90%, 50%, 60%, 90% and 50% respectively (Column 4). These recycling values are entered in the waste footprint output table of the waste footprint analyser for the waste footprint analysis. This will generate the waste footprint for present, targeted and projected values of each category of waste. Table 5.2 shows, how the waste categories and their recycling levels affects footprint.

Table 5.2 Waste Categories and Different Recycling Levels Affecting Footprint

Waste Category	Recycling (%)			Waste Footprint (in m <sup>2</sup> /capita)		
	Present	Targeted	Projected	Present	Targeted	Projected
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
Paper	0	60	90	3.26	2.36	1.92
Glass	0	30	50	2.85	2.58	2.42
Metal	0	30	60	23.35	16.69	10.04
Organic waste	0	75	90	96.76	54.67	46.25
Plastic	0	25	50	2.64	2.18	1.72
<b>Total waste footprint (m<sup>2</sup>/capita)</b>				<b>128.86</b>	<b>78.48</b>	<b>62.35</b>

The calculations in the Table 5.2 anticipates a 39% reduction (128.86 get reduced to 78.48) in footprint value through the above said programmes, if implemented in the city and suburbs. Also a maximum of 51% (128.86 get reduced to 62.35) reduction in footprint value can be attained through the high optimistic value of recycling.

### ii. Analysis based on different waste generation levels

An analysis of the different waste generation levels is are shown in Table 5.3. On entering the various waste reduction level values as given in the table to the waste footprint output table provided by the waste footprint analyser, the present, targeted and projected waste footprint values are obtained.

Table shows that, with present waste generation trend the footprint is 128.86 m<sup>2</sup> per capita which get reduced to 69.67m<sup>2</sup> per capita by targeted waste reduction levels (Column 3). By projected waste reduction levels (Column 4) the footprint values get reduced to 24.09 m<sup>2</sup> per capita. Therefore we can observe a proportional decrease in the footprint value with decrease in waste generation. On comparing targeted and projected footprint values in Table 5.2 and 5.3, it is clear that, the source reduction proved to be the first order hierarchy, as per the waste management hierarchy theories in terms of waste footprint values. In other words, we can say that by targeted recycling levels only 39% (128.86 m<sup>2</sup> to 78.48 m<sup>2</sup>) footprint reduction can be achieved whereas by targeted waste reduction levels 46% (128.86 m<sup>2</sup> to 69.67 m<sup>2</sup>) reduction in footprint values can be achieved. Likewise by projected recycling levels, only 51% (128.86 m<sup>2</sup> to 62.35 m<sup>2</sup>) footprint reduction is obtained whereas 81% (128.86 m<sup>2</sup> to 24.09 m<sup>2</sup>) footprint reduction can be achieved by projected waste reduction levels.

Table 5.3 Different Waste Generation Levels and Footprint Values

Waste Category	Waste generation			Waste Footprint		
	Present kg/capita/day	Targeted reduction (%)	Projected reduction (%)	Present footprint	Targeted footprint	Projected footprint
1	2	3	4	5	6	7
Paper	0.01	50	80	3.26	1.63	0.651
Glass	0.03	30	50	2.85	1.99	1.42
Metal	0.05	30	50	23.35	16.35	11.68
Organic waste	0.42	50	90	96.76	48.38	9.68
Plastic	0.01	50	75	2.64	1.32	0.66
<b>Total waste footprint (m<sup>2</sup>/capita)</b>				<b>128.86</b>	<b>69.67</b>	<b>24.09</b>

iii. Analysis Based on the Combination of Waste Reduction and Recycling

The combined analysis of a situation where there is waste reduction and appropriate recycling is given in Table 5.4. According to the analysis, with the recycling techniques proposed to launch in the city as explained earlier in the methodology part (targeted recycling Column 6) and a 50% reduction in paper, organic and plastic waste; 30% reduction in glass and metal waste generation, a reduction in the waste footprint value to 66.5% (i.e. 128.86 get reduced to 43.09 m<sup>2</sup> per capita) can be obtained.

Table 5.4 Combined Analysis of Waste Reduction and Recycling

Waste Category	Present			Targeted (%)			Projected (%)		
	Generation (kg)	Recycling	Footprint	Reduction in Generation	Recycling	Footprint	Reduction in Generation	Recycling	Footprint
1	2	3	4	5	6	7	8	9	10
Paper	0.01	0	3.26	50	60	1.18	80	90	0.38
Glass	0.03	0	2.85	30	30	1.81	50	50	1.21
Metal	0.05	0	23.35	30	30	11.68	50	60	5.02
Organic	0.42	0	96.76	50	75	27.33	90	90	4.62
Plastic	0.01	0	2.64	50	25	1.09	75	50	0.43
<b>Total waste footprint (m<sup>2</sup>/capita)</b>			<b>128.86</b>	<b>43.09</b>			<b>11.66</b>		

In the maximum optimistic level (i.e. 80% reduction in paper waste generation and 90% recycling of paper; 50% reduction in glass waste generation and with 50% recycling; 50% reduction in metal waste generation and with 60% recycling; 90% organic waste reduction and 90% recycling; 75% reduction in plastic waste and 50% recycling), 91% (i.e. 128.86 get reduced to 11.66 m<sup>2</sup> per capita) reduction of the present waste footprint of the city can be achieved.

iv. Projected Land Requirement for Waste Management of the City

The land required for waste management for the total population of the city over the years based on the present, targeted and projected waste footprint values per person is shown in Table 5.5. It shows that, with the present trend of waste generation and a population growth rate of 4.5% (Census, 2011), by 2051, the population will need about the full area of the city (9244.3 hectares) to assimilate the generated waste.

Table 5.5 Projected Land Requirements for the Waste Management of the City with respect to Waste Footprint Values

Year	Population	Waste footprint / person (hectares per capita)			Land area in hectares required for the waste management of the total population based on		
		Present	Targeted	Projected	Present footprint	Targeted footprint	Projected footprint
2001	595575	0.0129	0.0043	0.0012	7674.6	2566.3	694.4
2011	601574	0.0129	0.0043	0.0012	7751.9	2592.2	701.4
2021	628645	0.0129	0.0043	0.0012	8100.7	2708.8	733.0
2031	656934	0.0129	0.0043	0.0012	8465.2	2830.7	766.0
2041	686496	0.0129	0.0043	0.0012	8846.2	2958.1	800.5
<b>2051</b>	<b>717388</b>	<b>0.0129</b>	<b>0.0043</b>	<b>0.0012</b>	<b>9244.3</b>	<b>3091.2</b>	<b>836.5</b>
2061	749671	0.0129	0.0043	0.0012	9660.3	3230.3	874.1
2071	783406	0.0129	0.0043	0.0012	10095.0	3375.7	913.5
2081	818659	0.0129	0.0043	0.0012	10549.2	3527.6	954.6

The analysis also shows that by the targeted value of footprint (43.09 m<sup>2</sup> per capita in Table 5.5), only 33% of the total area (3091.2 hectares) of the city is required for waste assimilation by 2051. Whereas by the projected value (11.66 m<sup>2</sup> per capita in Table 5.5) only 9% area of the city (836.5 hectares) is required for waste assimilation by 2051.

## VI. CONCLUSION

The paper analyzed various sustainable options for reducing the waste footprint values of Kochi city through different waste reduction and recycling levels and a combination of the both. The different levels were present, targeted and projected. The present levels were the recycling and waste generation levels observed during the primary survey. The targeted levels were finalized based on various recycling and waste reduction initiatives which are in the pipeline and going to implemented in the residential areas of the city and outskirts. The projected levels were fixed considering the maximum recycling levels practiced in other urban areas over the world that can reduce the waste footprint to considerable levels and the maximum waste reduction that can be achieved at the optimistic level.

The analysis of different recycling levels anticipates a reduction of footprint values from 39% to 51%. About 46% to 81% reduction in footprint values is observed through different waste generation levels. Through the analysis of combination of different waste reduction and recycling levels, the footprint values showed reduction from 66.5% to 91%. Therefore the analysis of various sustainable options for reducing the waste footprint of Kochi city proved that source reduction especially that of organic and plastic waste, along with recycling of all the wastes will reduce the waste footprint effectively in the urban residential areas.

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# Structural and stratigraphic evaluation of Kashmir Basin at Himalayan core Belt

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University of Azad Jammu and Kashmir Muzaffarabad Pakistan.

**Abstract-** As Hazara Kashmir Syntaxes is the part of Himalayan Fold and thrust belt situated in sub- Himalayan and the studied area lies in the southern part of the Hazara Kashmir Syntaxis Pakistan. The Hazara Kashmir Syntax is an antiformal structure. The core of syntaxis comprises of Himalayan molasse deposits. These molasse deposits ranging from Early Miocene to Recent are exposed in the area. This study deals with the structure and stratigraphy of Bator, Gawandh, Dhulian Jattan and Rajdhani areas of Azad Kashmir and Pakistan. The Himalayan molasse deposits are exposing in the southern Hazara Kashmir Syntaxis. The study area includes The Middle Miocene to Recent molasse sedimentary deposits are exposed in the project area. The exposed sedimentary sequence includes the Chinji Formation, Nagri Formation, Dhok Pathan Formation, Soan Formation and Recent alluvium. The area is deformed into folds and faults due to Himalayan orogeny. The major folds in study area are Palak Syncline, Gawandh Anticline, Rajdhani Syncline and Nar Saniah anticline. The folds are northwest southeast trending and northeast or southwest vergent. These folds are closed in nature. The study area consists of four major faults primarily Gawandh fault, Kotli Sarsawah fault and Bajwal Banyan fault. Dhongolo fault is the splay of the Kotli Sarsawah fault. Faults and folds are northwest southeast trending and are related to Himalayan compression.

**Index Terms-** Syntaxis, Kashmir Basin, lithology, folds, faults and plates.

## I. INTRODUCTION

The study area is the part of Hazara Kashmir Syntaxis. It lies in districts Kotli and Mirpur, Azad Kashmir, Pakistan. This area includes Bator, Gawandh, Dhullian Jattan, and Rajdhani areas. The area lies between longitudes 73° 47' 30" to 73°50' 00" E and latitudes 33°15' 00" to 33° 23'20" N and lies on topographic sheet no 43 G /15 of the Survey of Pakistan (Fig 1.1, Plate 1). The project is located in the southeastern part of the Hazara Kashmir

Syntaxes and is imbricated along Jhelum Fault, Riasi Fault, Punjal Thrust and Main Boundary Thrust (Baig and Lawrence, 1987). The western limb of the Hazara Kashmir Syntaxes terminated by regional Jhelum Fault (Figure 1.1). The exposed sedimentary sequence of the project area includes the molasse rocks sediments of Siwalik Group. The stratigraphic sequence includes Chinji Formation, Nagri Formation, Dhok Pathan Formation and the Soan Formation. The age of these formation ranges from Middle Miocene to Pliocene. The Recent alluvium overlies unconformably on the earlier rock formation. The workers like Ashraf *et al.* (1983), Wells and Gingerich (1987), and also Geological Survey of Pakistan carried only regional geological mapping and stratigraphic.

1. To prepare the geological and structural map of the project area.
2. To prepare detail structural cross sections of the area.
3. To prepare  $\beta$  and  $\pi$  diagrams for structural analysis of the area.

## II. METHODOLOGY

The data acquired in 30 days field work Traverses were made along and across the strike of the different rock units (Plate1). The Brunton compass was used to measure the attitude of different bedding planes of rock units the in study area. The facing of rock units were determined on the basis of sedimentary structures. The structural data is plotted on the stereonet and presented in the tables. Cross-sectional profiles of structural and stratigraphic sequence was constructed. Distinguished feature of folds and faults have been recognized and with the help of this data mapping has been accomplished i.e Traverse route Map (Plate 1) Geological Map (Plate 2), Structural Map (Plate 3) and Structural Cross-sections (4a, 4b, 4c, 4d, 4e, 4f, 4g and 4h).

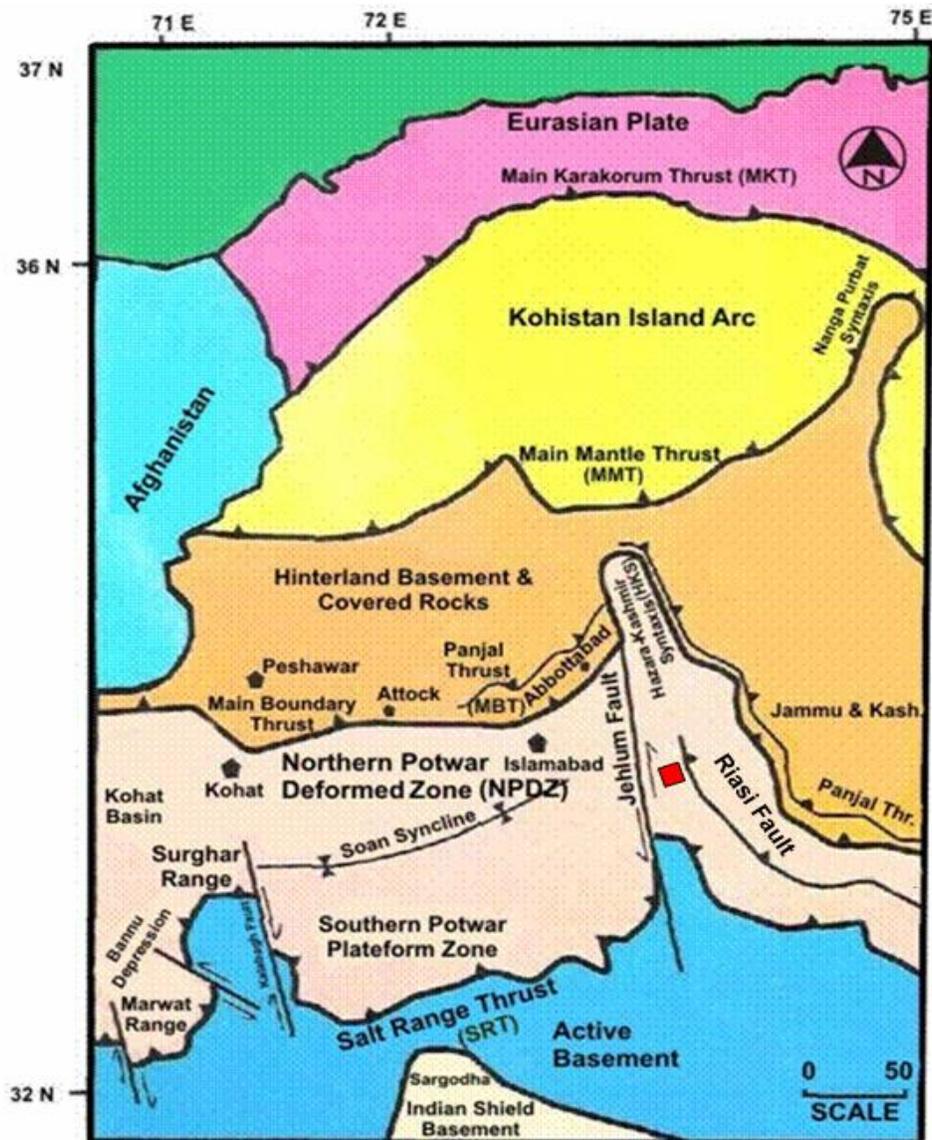


Figure 1.1 Regional tectonic map of the northwest Himalayas of Pakistan. The rectangle shows the location of the area (Modified after Baig and Lawrence 1987; Monaliza and Azam, (2004).

Table .1 Stratigraphic sequence of the Kashmir Basin

Formation	Age	Description
Quaternary alluvium	Recent	Consist of silt, gravel and unconsolidated deposits of clay
.....Unconformity.....		
Mirpur Formation	Pleistocene	Consist of conglomerates having cobbles and pebbles of igneous, metamorphic and sedimentary rocks
.....Unconformity.....		
Soan Formation	Pliocene	Consists of clays, claystone and grey sandstone. Clays are brown, yellowish grey in colour
Dhok Pathan Formation	Late Miocene	Dominantly consists of sandstone, siltstone and clays. Sandstone is grey, fine to medium grained and medium to thick bedded
Nagri Formation	Late Miocene	Dominantly it consists of greenish grey sandstone, siltstone and clays. Sandstone has massive beds and has medium to coarse grained texture. Sandstone alternates with clay and are 70% and 30% respectively.
Chinji Formation	Middle to Late Miocene	Red to purple, greenish grey, ash grey sandstone and siltstone and purple and reddish brown mudstone. 40% clays and 60% sandstone.
Kamlial Formation	Early to middle Miocene	Mainly sandstone, clays and intraformational conglomerates
Murree Formation	Early Miocene	Mostly clays, shales and sandstone. Sandstone is red to purple red in colour and is fine to medium grained.
Kuldana Formation	Middle to Late Eocene	Variegated shales with subordinate sandstone. Shales are arenaceous.
Chorgali Formation	Early Eocene	Mostly Calcareous shale, limestone and dolomitic limestone
Margalla Hill Limestone	Early Eocene	Dominantly nodular fossiliferous limestone with subordinate shales
Patala Formation	Late Paleocene	Mainly shales interbedded with marl and limestone
Lockhart Limestone	Early Paleocene	Grey to dark grey limestone with subordinate shales
Hangu Formation	Early Paleocene	Mainly Laterite, bauxite and fireclay
.....Unconformity.....		
Muzaffarabad Formation	Cambrian	Mainly Dolomitic limestone with cherty dolomite and chert bands.
.....Unconformity.....		
Dogra Formation	Precambrian	Slates, phyllite and shales with minor amount of limestone and graphite.
.....Unconformity.....		
Precambrian Basement rocks		

### III. REGIONAL STRATIGRAPHY OF THE KASHMIR BASIN

In Kashmir basin the stratigraphic units constitute the cover sequence of Indian Plate. The early workers like (Wadia (1928), Lydekker (1883), Wells and Gingerich (1987)) have established regional stratigraphy of the area. The regional stratigraphy of Kashmir Basin is presented in table 2.1.

### IV. STRATIGRAPHY OF THE STUDY AREA

The study area is comprises stratigraphic units of Siwalik Group of rocks. The exposed Siwalik group's stratigraphic sequence includes the Chinji Formation, Nagri Formation, Dhok Pathan Formation and the Soan Formation of Late Miocene to Pliocene and recent Alluvial cover (Table 2.2). These formations are described as under:

**Table . The Stratigraphic sequence of the pro ect area**

Formation	Age	Description
Recent Alluvium	Recent	Unconsolidated deposit of clay, gravel, pebbles <i>etc.</i>
.....Unconformity.....		
Upper Soan Formation	Pliocene	The Upper Soan Formation is composed of thick hard and massive conglomerates with minor clays.
Lower Soan Formation	Pliocene	The Lower Soan Formation is composed of sandstone and clay with subordinate conglomerate levels. The bentonite clay is also found in the lower part.
Dhok Pathan Formation	Late Miocene	Cyclic deposition of clay and sandstone, Ribbed topography, flaser or lenticular bedding, hard and compact conglomerate and pink garnet.
Nagri Formation	Late Miocene	Sandstone and clays. Sandstone massive and thickly bedded.
Chinji Formation	Middle to Late Miocene	Red to purple, grey, ash grey sandstone and mudstone. It consists of 60% clays while 40% sandstone.

#### Chinji Formation

The Chinji Formation is exposed near Gawandh and Hatta colony area (Plate 1 and 2). The Formation is dominantly composed of variegated clays (Photo 2.1) and sandstone. The clays are brown grey and purple. The sand stone is grey to ash grey coloured and is fine grained to medium grained. The clays are 60%

to 70%. Intraformational conglomerates are also found in the Chinji Formation. The sand stone of Chinji Formation contains of quartz, muscovite, biotite, tourmaline, epidot and garnet. The Formation is underlain by the Kamlial Formation with a gradational contact while upper contact with the Nagri Formation is faulted in the study area. The age is Middle to Late Miocene.



**Photo .1 Photograph showing different clay and grit level in Chin i Formation. Photograph facing Northeast (Station no. PR-1 Plate 1).**

### **. . Nagri Formation**

The Nagri Formation is exposed in our project area in Gawandh and Billi Puhrian areas (Plate 1 and 2). The Nagri Formation is mainly composed of sandstone and clays. The fresh colour of sandstone is greenish grey and weathered colour is dark grey to brownish grey. The sand stone is medium to coarse grain, and at places bluish grey and dull red. The sandstone in Nagri Formation is 60% to 70%, while some parts of the Nagri Formation have 80% sandstone with subordinate clays. The characteristic feature of Nagri sandstone is salt and pepper texture. The shale is

yellowish, reddish and blackish. The conglomerate layers are also present in the Formation having pebbles and gravels of older rocks like punjal volcanic and quartzite. The volcanic clasts are present in upper part of the Nagri Formation. The cross bedding (Photo 2.2) and load casts are the sedimentary structure observed in the Nagri Formation. The lower contact with the Chinji Formation is faulted while the upper contact with the Dhok Pathan Formation is gradational in the study area. The age of Nagri Formation is Late Miocene.



**Photo . Photograph showing cross bedding in sand stone of Nagri Formation. Photograph facing northeast (Station no. BP - Plate 1)**

### . . Dhok Pathan Formation

The Dhok Pathan Formation is exposed in Mera Kandi, Batar, Ganol, Palak, Dulian Jatta, Tarnat and Rajdhani area (Plate 1 and 2). The Dhok Pathan Formation is composed of sandstone with alternating clays and hard compact conglomeratic beds. The sandstone to clay ratio is 50:50 in the Dhok Pathan Formation. The sandstone is commonly grey, light grey, brownish red and greenish grey. The clay is orange, brown, dull red or reddish brown and greenish yellow. The sandstone of Dhok Pathan Formation is friable. Mineralogically, the Dhok Pathan Formation composed of garnet, epidote, quartz, mica, feldspar, hornblend and tourmaline.

The sedimentary structures like cross bedding, rip up, and load casts are observed in the study area. Lenticular bedding and the ribbed topography (Photo 2.3) are the characteristic features of the Dhok Pathan Formation. The Dhok Pathan Formation can be marked on the basis of ribbed topography and presence of pink garnet. The lower contact with the Nagri Formation is gradational while its upper contact with the Soan Formation is faulted in the study area. The age of the Dhok Pathan Formation is Late Miocene.



**Photo . Photograph showing lenticular bedding in Dokh Pathan Formation. Photograph facing southwest (Station no. DB-4 Plate 1).**

### . .4. Soan Formation

The Soan Formation is exposed in study area near Dhonglo, near Chaksawari, Liaqatabad areas (Plate 1 and 2). The Soan Formation consists of compact, massive conglomerate levels, clays (Photo 2.4) with subordinate interbeds of varicoloured sandstone and siltstone.

#### . .4.1 Lower Soan Formation

The Lower Soan Formation is mainly exposed in Dhonglo and Mera Kandi. The Soan Formation is composed of sandstone and clay with subordinate conglomerate levels. The bentonite clay is also found in the lower part (Plate 1 and 2). The sandstone is

friable, coarse grained and less compacted. The sandstone is composed of quartz, biotite, hornblend and garnet. Clays are khaki.

#### Upper Soan Formation

The Upper Soan Formation is mainly exposed in Dhonglo area. The Upper Soan Formation is composed of thick hard and massive conglomerates (Plate 1 and 2) with minor clays. The conglomerates contain pebbles and boulders of quartzite, limestone, cherty dolomite and granite gneisses. The clays are brown, yellowish and gray.) The age of the Soan Formation is Pliocene.



**Photo .4** Photograph showing compact, massive conglomerate levels and clays in Soan Formation. Photograph facing northeast (Station no. D - 4 Plate 1).

**Recent Alluvium**

The Recent deposits include terrace deposits and alluvium. These terraces are horizontally bedded clays and gravels which are yellowish in color. It unconformably blankets the bed rocks of different ages. The age of the alluvium is Recent.

**STRUCTURE**

The project area is a part of Sub Himalayas of Pakistan. The area is tectonically very active containing mostly regional folds and faults. This area lies in the southern Hazra Kashmir Syntaxis. The Hazara Kashmir Syntaxis is an antiformal structure which is formed by the folding of Himalayan thrust sheets. The project area is bounded by Jhelum Fault to the west, Riasi Fault to the east and the Salt Range thrust to the south. The folds of the project area are northwest southeast trending. Structurally the project area is highly deformed. The different structures like folds and faults are present in the area. The detailed description of the structures of the area is described as under:

**a. Folds**

Study area composed four regional folds. These folds are the Palak syncline, Rajdhani syncline, Gawandh anticline and Nar Saniah anticline. These folds are northeast vergent closed folds.

**1. Palak Syncline**

The Palak syncline is formed by the folding of Nagri Formation and Dhok Pathan Formation (Plates 3, and 4a; Cross section EE', FF' and GG'). The Dhok Pathan Formation lies in the core whereas Nagri Formation is on the limbs of the Palak syncline.

The strike of the northeastern limb varies from N30°W to N52°W, whereas the strike of the southwestern limb varies from N45°W to N55°W. The dip of northeastern limb varies from 60°SW to 61°SW whereas, southwestern limb ranges from 51°NE to 60°NE (Table 3.1).

The northeastern limb is relatively steeper than the southwestern limb. The attitude of axial plane varies from N45°W/89°SW to N47°W/85°SW. The trend and plunge of fold axis varies from 4°/315° to 10°/313° (Table 3.1; Plate 3; Fig. 1.2; Figs β1 and β2). The Palak syncline is a northwest plunging and northeast vergent fold. The interlimb angle varies from 60° to 69°. On the basis of interlimb angle the fold is classified as a closed fold.

**Table .1** Structural data for the Palak Syncline

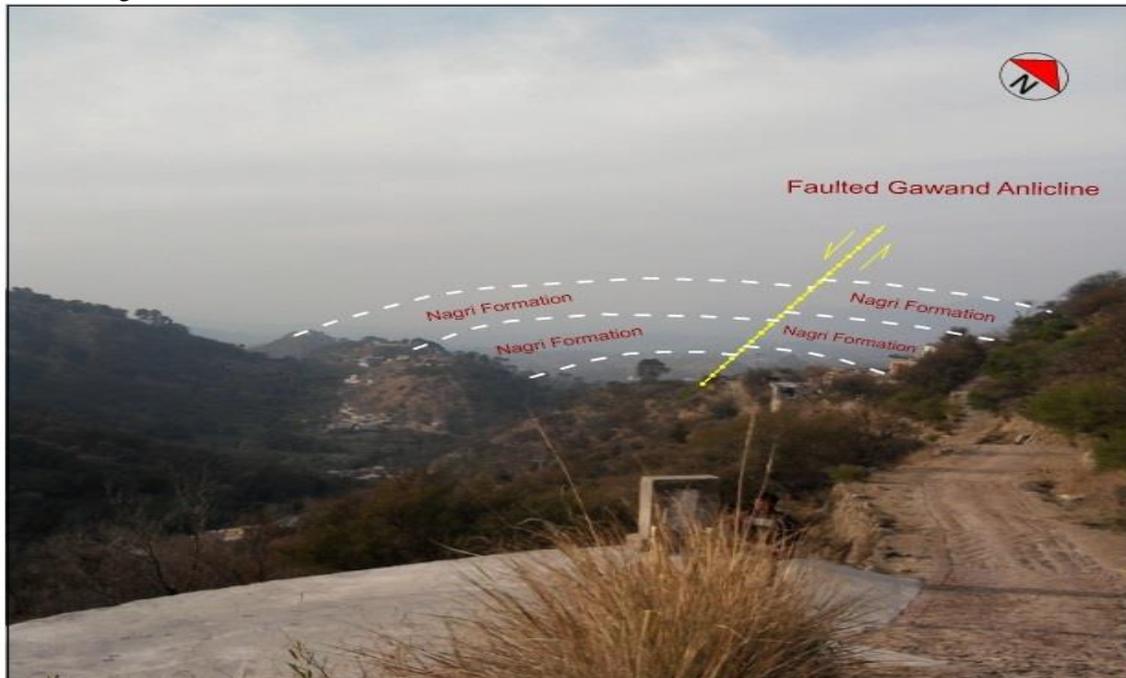
Attitude of bedding		Axial plane	Fold axis	Interlimb angle	Type of fold
Northeastern limb	Southwestern limb				
<b>Northwestern</b>					
<b>Part (β<sub>1</sub>)</b> N52°W/60°SW	N55°W/60°NE	N45°W/89°SW	4°/315°	60°	Closed

Southeastern					
<b>Part (β )</b> N30°W/61°SW	N45°W/51°NE	N47°W/85°SW	10°/313°	69°	Closed

**awandh Anticline**

The Gawandh Anticline is formed by the folding of Nagri Formation and Dhok Pathan Formation (Plates 2, 3, and 4a; Cross section CC', DD', EE' and FF'). The Nagri Formation is in the core while the Dhok Pathan formation is on the limbs of the anticline (Plates 3, and 4a, Photo 2.5, 2.6, Plate 1). The strike of the northeastern limb ranges from N25°W to N45°W, whereas the

strike of the southwestern limb varies from N42°W to N58°W. The dip of the northeastern limb ranges from 60°NE to 60°NE, whereas the dip of the southwestern limb varies from 30°SW to 40°SW. The Gawandh anticline is faulted anticline. The core of the Gawandh anticline is faulted due to the Gawandh fault.



**Photo . Photograph showing core faulted awandh Anticline. Photograph facing southwest (Station no. D-7 Plate 1).**

**Ra dhani Syncline**

The Rajdhani Syncline is formed by the folding of Nagri Formation and Dhok Pathan Formation (Plates 3, and 4a; Cross section BB', CC' and DD'). The Dhok Pathan Formation is in the core whereas the Nagri Formation lies on the limbs of the Rajdhani syncline (Photo 2.6 and 2.7, Plate 1)

The strike of the northeastern limb ranges from N19°W to N52°W, whereas the strike of the southeastern limb varies N28°W to N60°W. The dip of the northeastern limb ranges from the

32°SW to 39°SW, whereas the dip of southwestern limb varies from 60°NE to 63°NE (Table 3.2).

The southwestern limb is relatively steeper than the northeastern limb. The attitude of the axial plane varies from N23°W/79°SW to N66°W/80°SW. The trend and plunge of the fold axis varies from 4°/294° to 6°/156° (Table 3.2; Plate 3; Fig. 1.2; Figs β3 and β4). The Rajdhani syncline is doubly plunging and northeast vergent fold. The interlimb angle varies from 71° to 85° (Table 3.2). On the basis of the interlimb angle the fold is classified as a closed fold.

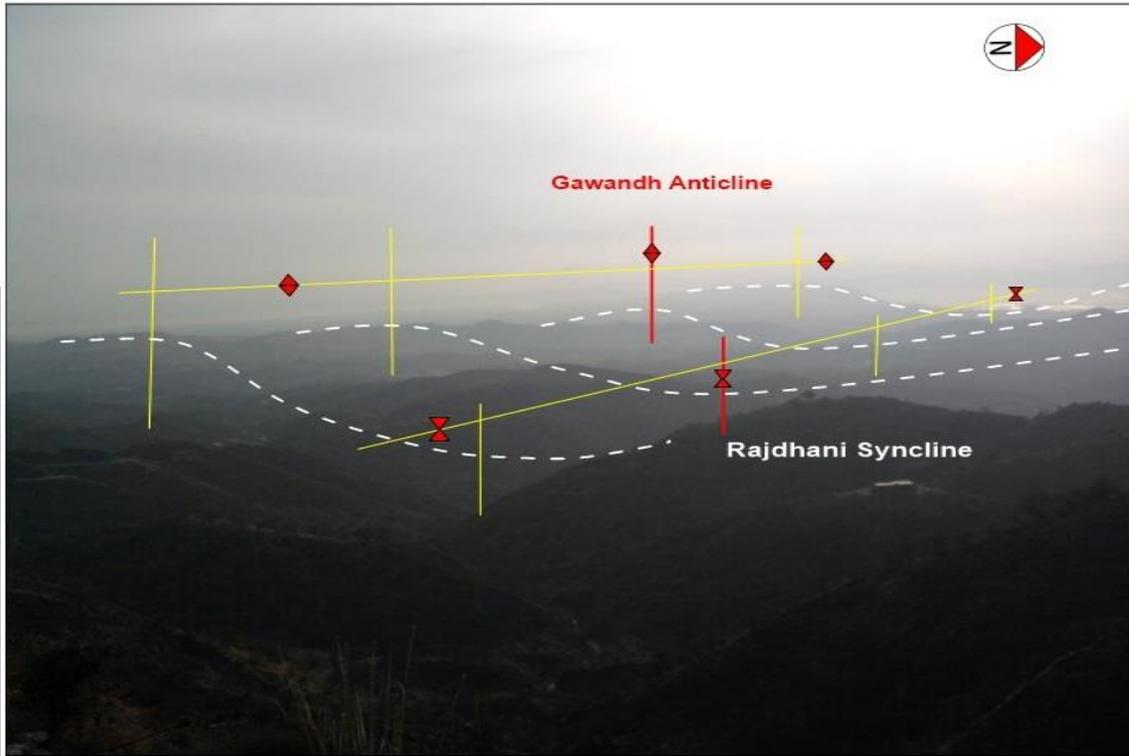


Photo .6 Photograph showing regional view of Gawandh Anticline and Rajdhani Syncline. (Station no.PR- Plate1).

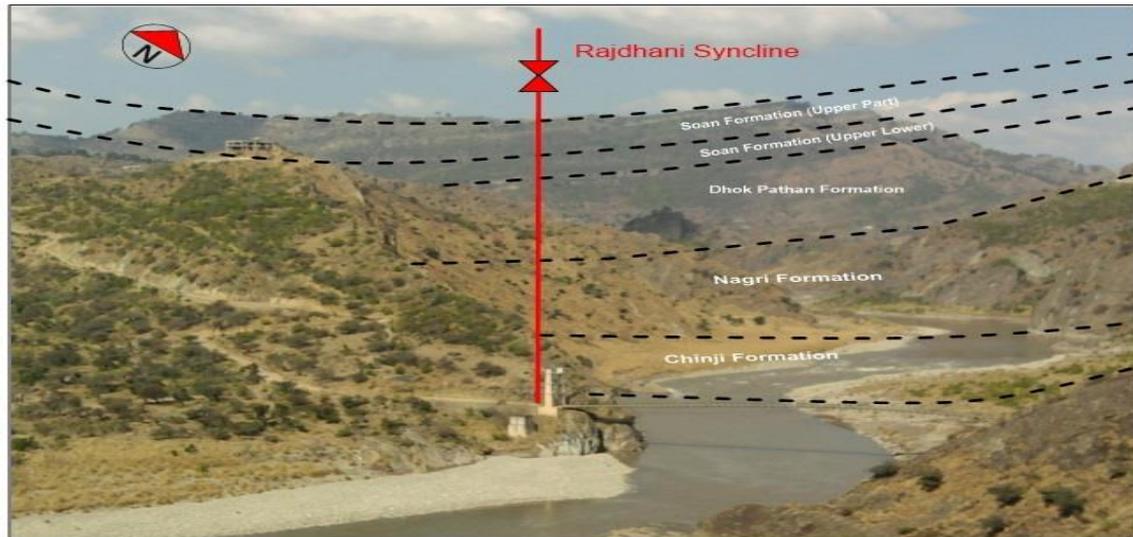


Photo .7 Photograph showing Rajdhani Syncline. Photograph facing southwest (Station no. R -4 Plate 1).

Table . Structural data for the Rajdhani Syncline

Attitude of bedding		Axial plane	Fold axis	Interlimb angle	Type of Fold
Northeastern limb	Southwestern limb				
Northwestern					

<b>Part (β )</b> N52°W/32°SW	N60°W/63°NE	N66°W/80°SW	4°/294°	85°	Closed
<b>Southeastern Part (β<sub>4</sub>)</b> N28°W/39°SW	N19°W/60°NE	N23°W/79°SW	6°/156°	71°	Closed

**4. Nar Saniah Anticline**

The Nar Saniah anticline is formed by the folding of Nagri Formation and Chinji Formation (Plates 3, and 4a; Cross section BB'). The Chinji Formation is in the core while the Nagri Formation is on the limbs of the anticline (Photo 2.8). The strike

of the southwestern limb ranges from N32°W to N38°W while the dip of southwestern limb varies from 41°SW to 42° SW. The northeastern limb is not exposed in our project area. The southwestern limb is exposed in Rajdhani and Hatta Colony area in the project area.



**Photo .8 Photograph showing Nar Saniah Anticline and Ba wal Banyan fault. Photograph facing southwest (Station no. PR-Plates 1).**

**b. Faults**

There are four major faults present in the project area are Gawandh Fault, Kotli Sarsawah fault, Bajwal Banyan fault and Dhonglo fault. These faults are reverse in nature.

**1. Kotli Sarsawah Fault**

The Kotli Sarsawah Fault is a reverse fault running northwest southeast in project area. The Kotli Sarsawah fault is in between Dhok Pathan Formation and Soan Formation (Plates 3, and 4a;

Cross section EE', FF', GG' and HH'). The Kotli Sarsawah fault is running northeast southwest. The Dhok Pathan Formation is thrust over the Soan Formation. Gouge, breccias and drag folds are present along the fault plane. The Dhok Pathan Formation is exposed in the hanging wall block while Soan Formation is exposed in footwall block. The attitude of the hanging wall block is N45°W/39°SW to N50°W/48°NE. The attitude of fault plane is N48°W/85°NE.



**Photo .9** Photograph showing Kotli Sarsawah fault. Photograph facing southwest (Station no. MK-8 Plate 1)

**Gawandh Fault**

It is the major fault passing through the project area which is reverse in nature. The Gawandh fault is a regional intraformational fault passing through the Nagri Formation. The Gawandh fault cuts the core of Gawandh anticline. The northeastern limb of Gawandh anticline is thrust over the southwestern limb (Plates 2, 3, and 4a; Cross section CC', DD',

EE' and FF'). The gouge and breccias are visible along the fault in the project area (Photo 2.10). It is passing through Gawandh area. The Gawandh fault is running northeast southwest. The attitude of hanging wall is N23°W/60°NE to N48°W/40°NE while the attitude of the foot wall is N39°W/40°SW to N50°W/60°SW. The attitude of fault plane is N43°W/80°NE.



**Photo .10** Photograph showing intraformational Gawandh fault. Photograph facing northeast (Station no. L- Plate 1)

**Bajwal Banyan Fault**

The Bajwal Banyan fault is regional fault passing through the field area. The Chinji Formation is thrust over the Nagri Formation along the Bajwal Banyan fault (Plates 2, 3, and 4a;

cross section BB'). The fault is passing through the southwestern limb of the Nar Saniah anticline (Photo 2.8). The Bajwal fault is running northeast southwest. The Chinji Formation is exposed in the hanging wall while Nagri Formation exposed in the footwall.

The attitude of the footwall is  $N32^{\circ}W/40^{\circ}SW$  while the attitude of hanging wall block is  $N38^{\circ}W/42^{\circ}SW$ . The attitude of fault plane is  $N40^{\circ}W/70^{\circ}NE$ . The fault is reverse in nature.

#### 4. Dhonglo Fault

The Dhonglo fault is a splay fault of Kotli Sarsawa fault. It is a reverse fault which has thrust the lower part of the Soan Formation over the upper part of the Soan Formation (Plates 2, 3,

and 4a; Cross section FF', GG' and HH'). The lower part of the Soan Formation acts as hanging wall while the upper part is the foot wall (Photo 2.11). The attitude of hanging wall block is  $N45^{\circ}W/5^{\circ}SW$  to  $N48^{\circ}W/10^{\circ}SW$  while the attitude of footwall block is  $N40^{\circ}W/12^{\circ}SW$  to  $N50^{\circ}W/24^{\circ}SW$ . The attitude of the fault plane is  $N45^{\circ}W/80^{\circ}NE$ .



**Photo .11 Photograph showing Dhonglo Fault between Soan Formation upper and lower part. Photograph facing southwest (Station no. MK -1 Plate 1).**

#### V. CONCLUSION

The project area lies in the southern part of Hazara Kashmir Syntaxis. The project area is comprised thick cover of sedimentary rocks of Himalayan molasse deposits. The molasses sequence exposed in the area includes the Chinji Formation, Nagri Formation, Dhok Pathan Formation and the Soan Formation.

The project area is highly deformed and regional folds and faults are present in the area. The faults are mainly thrust faults and northwest-southeast trending. The folds are tight to closed and southwest or northeast vergent.

The major folds in the area are Palak Syncline, Gawandh Anticline, Rajdhani Syncline and Nar Saniah Anticline.

The major faults in the area are mainly Gawandh Fault, Kotli Sarsawa Fault, Bajwal Banyan Fault and Dhonglo Fault.

#### VI. DISCUSSION

The project area lies along the southern part of the Hazara-Kashmir Syntaxis in the sub-Himalaya of Pakistan which is developed after the Tertiary collision of the Indian and Eurasian Plates (Bossart *et al.*, 1988). The south and southwestern part of the Hazara Kashmir Syntaxis is imbricated along Panjal thrust, MBT and Salt Range thrust (Baig and Lawrence, 1987). The western limb of the Hazara Kashmir Syntaxis is displaced by left

lateral strike slip Jhelum Fault. The core of the the syntaxis is highly deformed.

The sedimentary rocks are exposed in the area range in age from Middle to Late Miocene to Recent. These include the Chinji Formation, Nagri Formation, Dhok Pathan Formation, Soan Formation and Recent Alluvium.

The area is highly deformed into large scale folds and faults due to stresses produced by the tectonic activities. The major folds of the area are the Rajdhani syncline, Gawandh anticline, Palak syncline, and Nar saniah anticline.

The Rajdhani syncline is formed by the folding of Dhok Pathan Formation and Nagri Formation. The Dhok Pathan Formation is in the core where as Nagri Formation lies on limbs. The southwestern limb is relatively steeper than the northeastern limb. It is northeast vergent and doubly plunging fold.

The Gawandh anticline is formed by the folding of the Nagri Formation and Dhok Pathan Formation. The Nagri Formation is in the core while the Dhok Pathan Formation is on the limbs. The core of the Gawandh anticline is faulted and cut by the Gawandh Fault. The Gawandh anticline is northwest southeast trending and northeast vergent fold.

The Palak Syncline is formed by the folding of Dhok Pathan Formation and Nagri Formation. Dhok Pathan Formation is in the core while the Nagri Formation lies on the northeastern limb. The southwestern limb is cut by the Kotli Sarsawah Fault due to which Soan Formation is thrust over the Dhok Pathan. The Palak

Syncline is northwest southeast trending and northeast vergent Fold.

The Nar-Saniah anticline is formed by the folding of Nagri Formation. The vergence of the fold is north or southwest limb. The Nar- Saniah anticline is a faulted anticline. The southwestern limb of the anticline is cut by Bajwal –Banyan fault.

The major faults are the Kotli Sarsawa fault, Gawandh fault, Bajwal Banyan fault and Dhonglo fault. The kotli Sarsawa fault is a reverse fault which separates upper part of the Soan Formation from the lower part of the Dhok Pathan formation. The Dhok Pathan Formation lies in hanging wall and Soan Formation in foot wall of the Kotli Sarsawa Fault. The Gawandh fault is reverse fault marked between the upper between upper and lower part of the Nagri Formation. The lower part of the Nagri Formation lies in the hanging wall and upper part of Nagri Formation in foot wall of the Gawandh Fault.

The Bajwal Banyan fault is a reverse fault between Chinji Formation and the Nagri Formation in which Chinji Formation is thrust over the Nagri Formation. The Chinji Formation lies in the hanging wall and Nagri Formation in foot wall of the Bajwal Banyan Fault. The Dhonglo fault is also reverse fault in which lower part of the Soan Formation is thrust over the upper Soan formation in the project area. The primary sedimentary structures like load casts, ripple marks and cross bedding are present in the study area.

#### Acknowledgement

I don't have appropriate words to express my deepest sense of gratitude to Almighty Allah Whose blessing did not let me deviate from the right direction even through trials and tribulations. I pay the tribute to the Holy Prophet Hazrat Muhammad (PBUH) for enlightening our conscious. All the every respect is for the Holy Prophet Who enables us to recognize our Creator. I am grateful to express deepest gratitude to my project supervisor honorable Prof. Dr. Mirza Shahid Baig and Prof. Shahab Pervez for his student friendly attitude and precious

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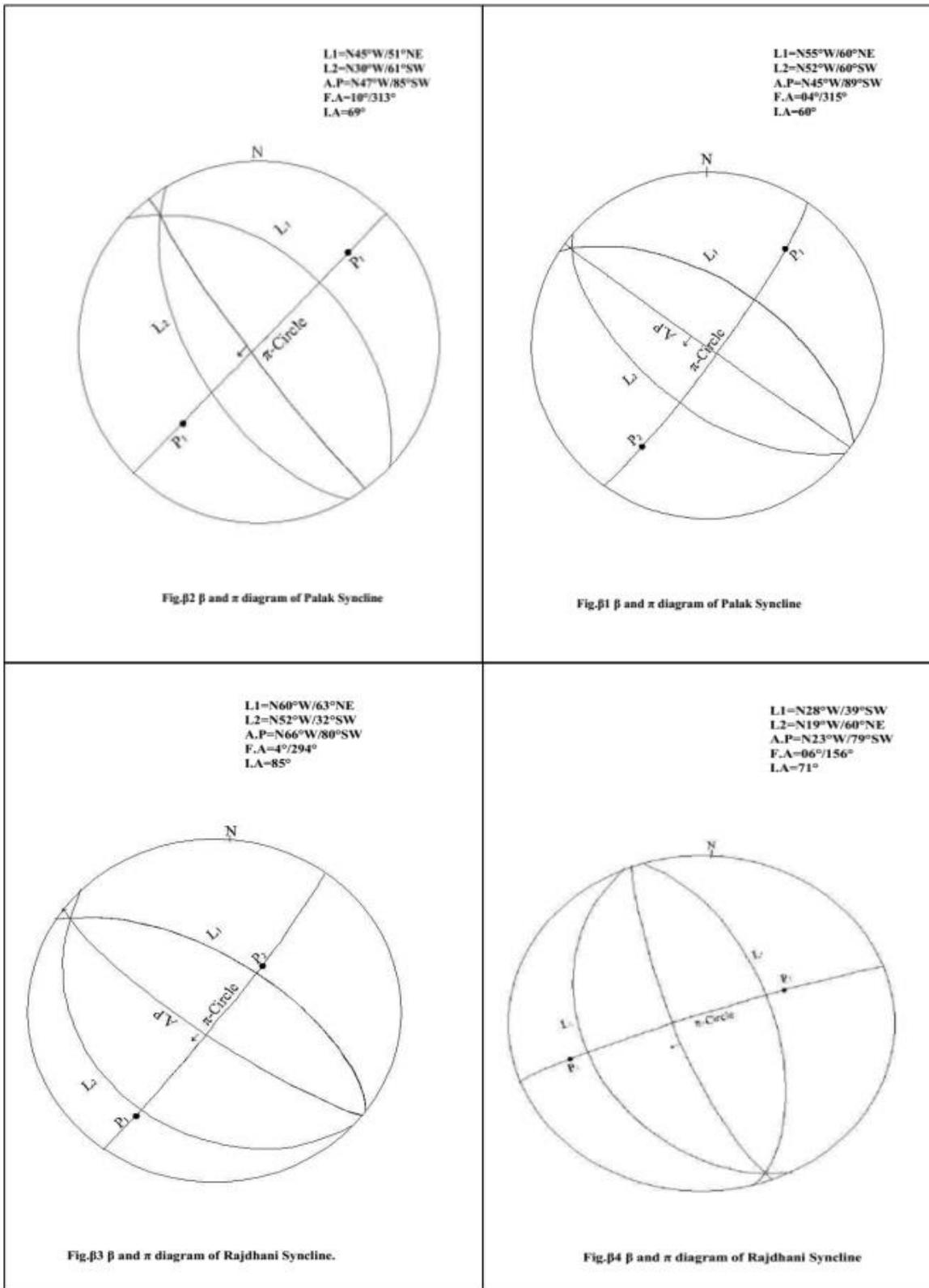
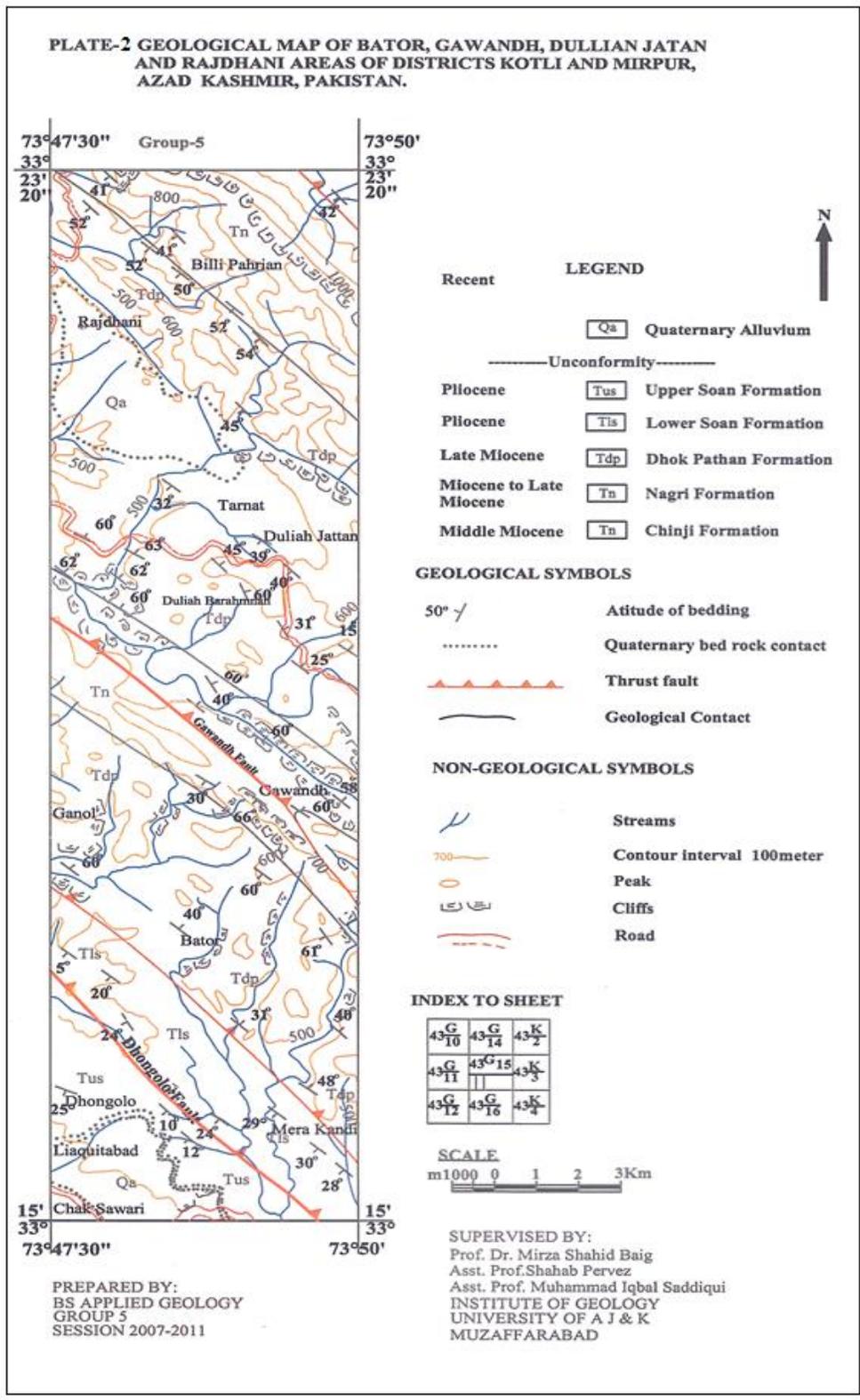


Figure: 1. . Beta Diagrams.





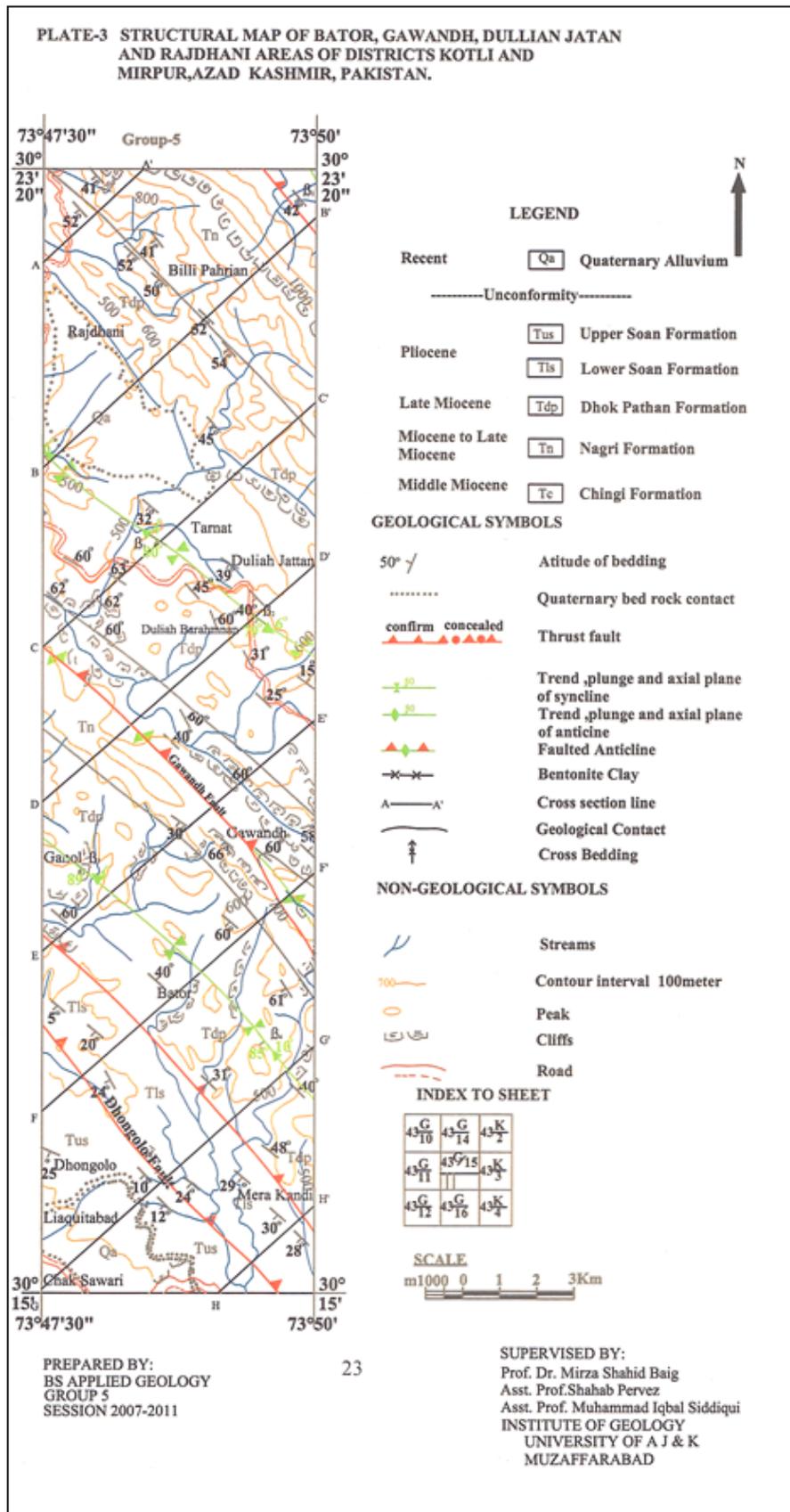


PLATE - 4a STRUCTURAL CROSS SECTIONS OF RAJGHANI, DULIAH JATTAN, CHAUK SAHIBAN AND NAMETAR AREAS OF THE DISTRICTS KOTLI AND MIRPUR, AZAD KASHMIR, PAKISTAN.

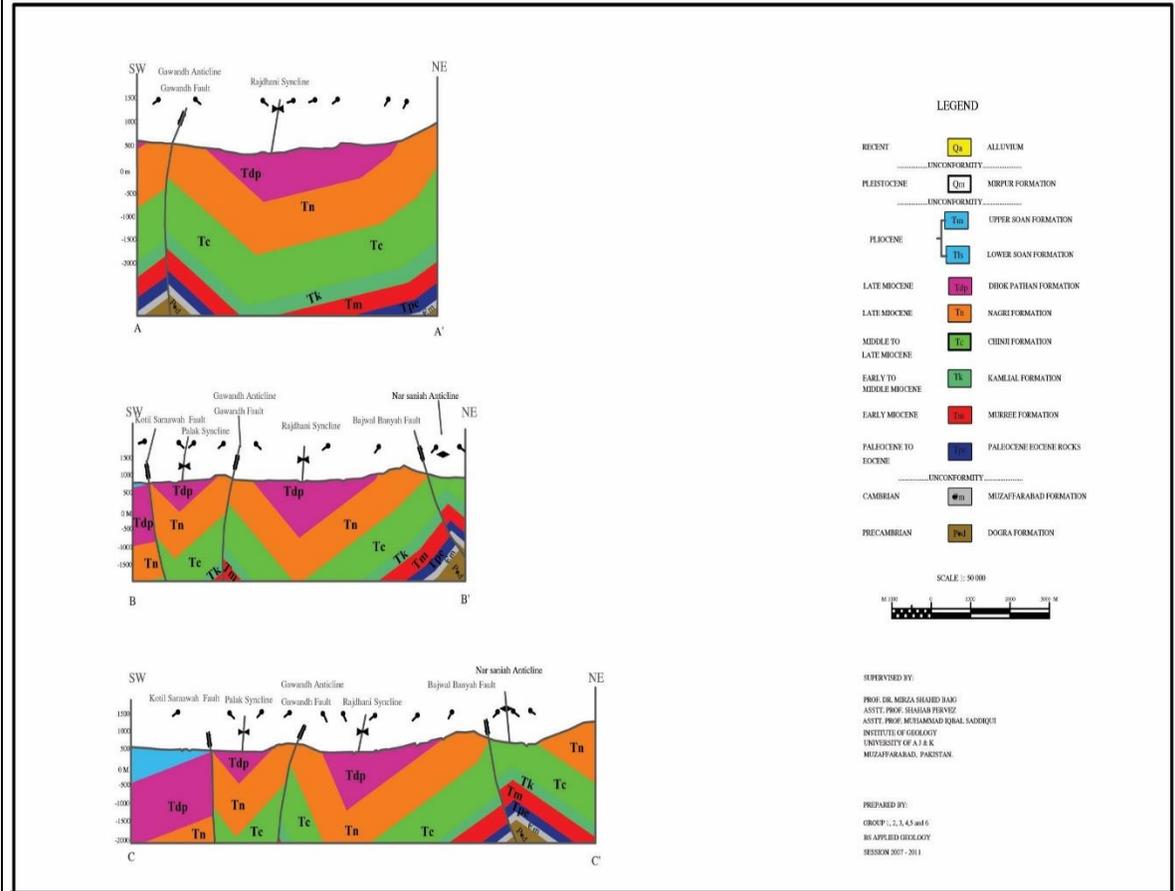


PLATE - 4a STRUCTURAL CROSS SECTIONS OF RAIGHANI, DULIAH JATTAN, CHAUK SAHIBAN AND NAMETAR AREAS OF THE DISTRICTS KOTLI AND MIRPUR, AZAD KASHMIR, PAKISTAN.

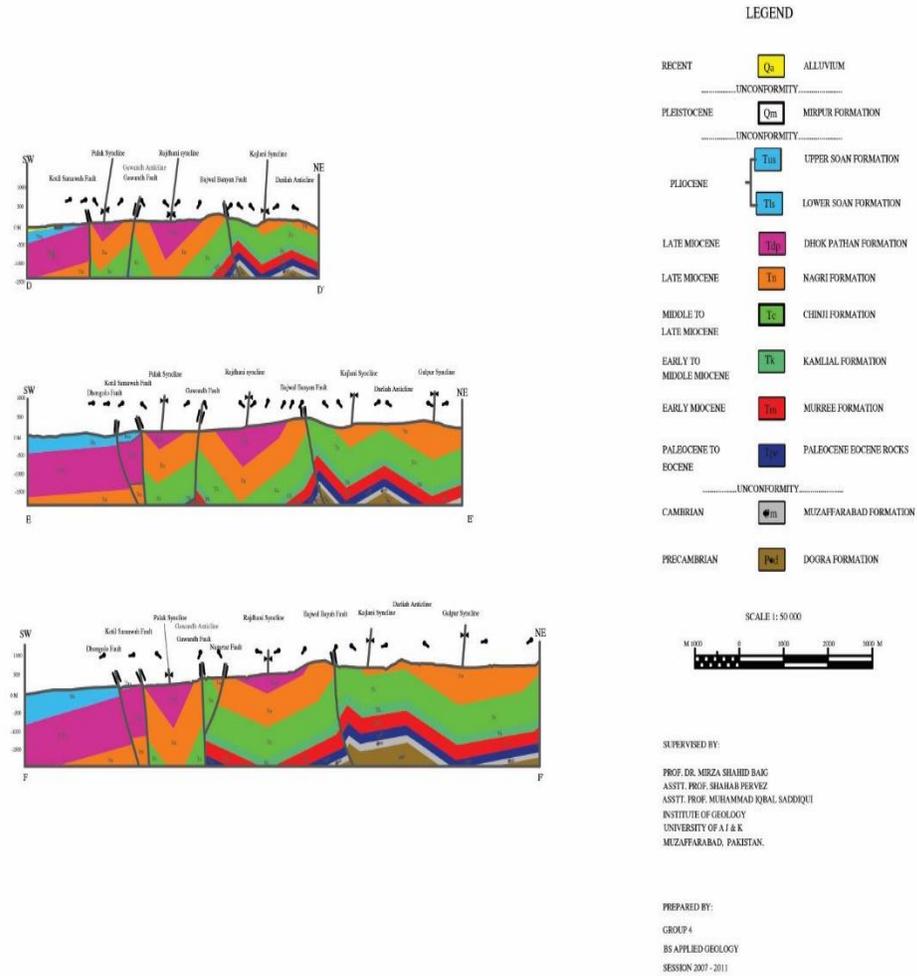
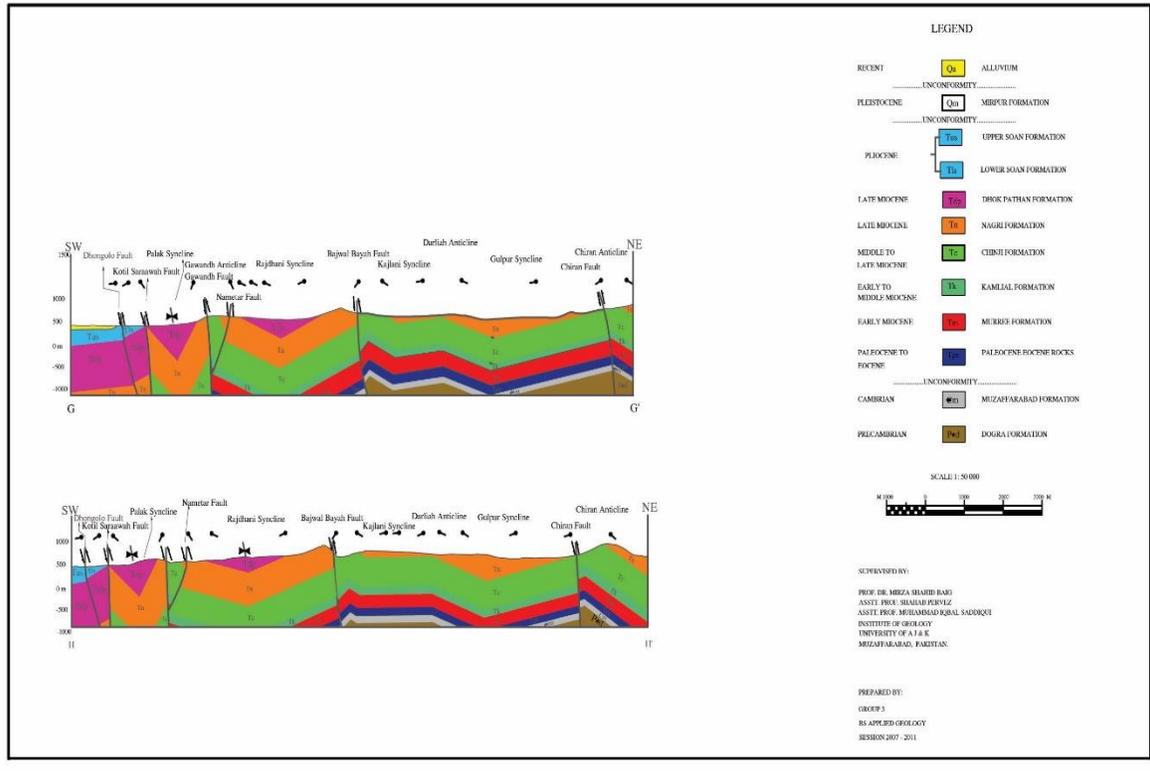


PLATE - 4a STRUCTURAL CROSS SECTIONS OF RAJGHANI, DULIAH JATTAN, CHAUK SAHIBAN AND NAMETAR AREAS OF THE DISTRICTS KOTLI AND MIRPUR, AZAD KASHMIR, PAKISTAN.



# Study of the Antimicrobial activity of Trichoderma-Silver fused Nanoparticles (TR-Ag Np<sup>0</sup>) against pathogenic bacterial and fungal strains

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**Abstract-** The genus, *Trichoderma* and its metabolites were meant for antimicrobial activity against the microbial strain and thus it is considered to be natural antimicrobial agents. Silver is also known as an antimicrobial agent and is utilized in several antimicrobials and medications. In the present investigation, the nano-particles were prepared both of *Trichoderma* and Ag<sup>+</sup> separately and further after fusing *Trichoderma* and Ag<sup>+</sup>. *Trichoderma harzianum* secretes secondary metabolites which act as a capping and reducing agent. The biosynthesized silver nanoparticles (AgNPs) were characterized by UV-Vis spectroscopy and Transmission electron microscopy (TEM). UV-Vis spectra of silver and *Trichoderma* filtrate showed absorption spectra at 450 nm and 430 nm respectively while fused nanoparticles showed absorption spectra at 415 nm corresponding to the surface plasmon resonance of silver nanoparticles. The size and morphology of the fused nanoparticles was determined by TEM, which shows the formation of spherical nanoparticles in the size range of 8–24 nm. The antibacterial activity of biosynthesized AgNPs, *Trichoderma* filtrate and fused TR-Ag<sup>0</sup> nanoparticles were evaluated by measuring the diameter of zone of inhibition against pathogenic microbial strains and drug resistant *Staphylococcus aureus*. It was also observed that, fused nanoparticles of *Trichoderma*-Ag<sup>0</sup> were having prominent antimicrobial activity in comparison to individual silver nanoparticles.

**Index Terms-** Nanoparticles, antimicrobial activity, silver, *Trichoderma*, secondary metabolites.

## I. INTRODUCTION

The anamorphic fungal genus *Trichoderma* (*Hypocreales*, *Ascomycota*) is cosmopolitan in soils and on decaying wood and other forms of plant organic matter [1]. *Trichoderma* species were among the most widely distributed and common fungi in nature and exist in climates ranging from the tundra to the tropics. This may be attributable to their diverse metabolic capability and aggressively competitive nature [2, 3]. Rapid growth rates in culture and the production of numerous spores (conidia) that were mostly varying shades of green characterize fungi in this genus. A growing number of teleomorphs in *Hypocrea* have been linked to commonly occurring *Trichoderma* anamorphs, but most strains of *Trichoderma* were classified as imperfect fungi because they have not been associated with a

sexual state. Interestingly, *Hypocrea/Trichoderma* spp. were even able to induce systemic resistance, which is characterized by the occurrence of disease control in the plant at a site distant from the location of *Hypocrea/Trichoderma*. *Trichoderma* species have been described as biological control agents against fungal and bacterial pathogens [4, 5]. They stimulate the production of low-molecular weight compounds that have antimicrobial activity like e.g. phytoalexins which were normally produced by plants in response to an attack by pathogens. A large were a of interest in biocontrol is the reduction of plant diseases caused by soil-borne and foliar plant pathogenic fungi. Roughly 70% of all the major crop diseases were caused by fungi, or the fungus-like Oomycota. Notorious examples were species belonging to the genera *Rhizoctonia*, *Botrytis*, *Phytophthora*, *Pythium*, *Sclerotinia* and *Fusarium*. Most of the formulations of commercially available biocontrol products against plant pathogenic fungi contain the bacteria *Pseudomonas* and *Bacillus* or fungi belonging to the genus *Hypocrea/Trichoderma*. *Hypocrea/Trichoderma* spp. produces a wide range of enzymes for degradation of homo- and hetero-polysaccharides, which were designative for their broad spectrum of substrate utilization and their ubiquitous occurrence in nature. Furthermore they possess a wide spectrum of proteases which help them in the defense of their habitats and the competition for nutrients with other microorganisms. Biological synthesis of metal nanoparticles involving the use of microbes is easy, cost-effective and eco-friendly technique. These nano-particles were effective, bio-compatible and bio-degradable [6]. Silver compounds have been used to treat burns, wounds and infections. Various salts of silver and their derivatives were used as antimicrobial agents [7, 8]. Recent studies have reported that nano-sized silver particles exhibit antimicrobial properties [9, 10]. Since *Trichoderma* sp. as a natural source and Ag<sup>+</sup> as synthetic source both have antimicrobial effect against the variety of pathogens. The present study described the effect of *Trichoderma*-Ag fused nanoparticles (TR-Ag Nps) on the variety of bacterial and fungal pathogens.

## II. MATERIALS AND METHODS

### Isolation of *Trichoderma* species from soil samples

To isolate *Trichoderma* from soil, selective medium was prepared [11]. The basal medium consisted of 0.2 g MgSO<sub>4</sub> (7H<sub>2</sub>O), 0.9 g K<sub>2</sub>HPO<sub>4</sub>, 0.15 g KCl, 1.0 g NH<sub>4</sub>NO<sub>3</sub>, 3.0 g D-

glucose anhydrous, 0.15 g Rose Bengal and 20g agar. These constituents were added to 950 ml of distilled water and autoclaved at 121°C for 30 minutes. The biocidal ingredients, 0.25g tetracycline were mixed in 50 ml of sterilized distilled water and added to the autoclaved basal medium where it cooled to 40 to 50°C. 10 grams of soil were suspended in 50 ml of sterile distilled water and agitated for 30 minutes at 200 rpm in a rotary shaker. Serial dilutions were made and 0.1 ml of each was spread on the *Trichoderma* selective medium plates with a glass rod. Three plates of each sample were prepared and incubated for 5 days at 30°C. *Trichoderma* isolates were collected and transferred onto potato dextrose agar (PDA) plates for maintaining pure culture [12].

### Cultivation and culture conditions

*Trichoderma* cultures obtained were cultivated and maintained on slants of potato dextrose agar for 5 days at 28°C. Three hundred milliliters flasks were incubated for 14 days at 28°C on a laboratory incubator. The fungal biomass was collected for further use.

### Microscopic and taxonomic identification of *Trichoderma* culture

Two techniques, visual observation on petri dishes and micro-morphological studies in slide culture, were adopted for identification of *Trichoderma* species. For visual observation, the isolates were grown on PDA agar for 3-5 days. The mode of mycelia growth, colour, odour and changes of medium colour for each isolate were examined every day. For micro-morphological studies, a slide culture technique was used [13]. Examination of the shape, size, arrangement and development of conidiophores or phialides provided a tentative identification of *Trichoderma* spp. Samples were compared to a taxonomic key for the genus *Trichoderma* [14] and further verified and confirmed by National Centre of Fungal Taxonomy, New Delhi, India.

### Preparation of *Trichoderma* filtrate

*Trichoderma* was inoculated in liquid nutrient medium containing consisted of 0.2 g MgSO<sub>4</sub> (7H<sub>2</sub>O), 0.9 g K<sub>2</sub>HPO<sub>4</sub>, 0.15 g KCl, 1.0 g NH<sub>4</sub>NO<sub>3</sub>, 3.0 g D-glucose anhydrous, 0.15 g Rose Bengal and 0.25 g tetracycline per 50 ml of sterilized distilled water and added to the autoclaved basal medium where it is cooled to 40 to 50°C. The culture was then after placed in incubator shaker at 200 rpm at 28°C for 5 days. Further filtered by Whatman's filter paper No. 42 to obtain filtrate. Then the mycelium and filtrate were separately subjected to solvent extraction.

### Extraction of the filtrate

The filtrate of each fungus was extracted several times with ethyl acetate (v/v) in a separating funnel. The extracts from both mycelia and filtrate were evaporated under vacuum at 50°C till dryness. The obtained solid material was dissolved in ethyl acetate to form the crude extract and tested for antimicrobial activity. For day optimization the fungus was grown in the malt extract medium at pH 6.2. Inoculated flasks were incubated at

27°C on an incubator shaker for 8 days. The biomass production was determined each day for antibacterial activity.

### Preparation of silver nanoparticles

For the preparation of silver nanoparticles two stabilizing agents, sodium dodecyl sulphate (SDS) and sodium citrate were used. For the synthesis of silver nanoparticles, silver nitrate solution (from 1.0 mM to 6.0 mM) and 8% (w/w) sodium dodecyl sulphate (SDS) were used as a metal salt precursor and a stabilizing agent, respectively. Hydrazine hydrate solution with a concentrate ranging from 2.0 mM to 12 mM and sodium citrate (1.0 mM to 2.0 mM) were used as reducing agents. Citrate of sodium was used as stabilizing agent at room temperature. The transparent colorless solution was converted to the characteristic pale yellow and pale red colour, when citrate of sodium was used as stabilizing agent. The occurrence of colour was indicated by the formation of silver nanoparticles. The silver nanoparticles were purified by centrifugation. To remove excess silver ions, the silver colloids were washed at least three times with deionized water under nitrogen stream. A dried powder of the nanosize silver was obtained by freeze-drying [15-19].

### Preparation of *Trichoderma* fused Silver nanoparticles

The silver nitrate (1 mM) solution was prepared in 50 ml deionized water. Fungal biomass (5 g) was brought in contact with the silver nitrate solution in a 200 ml Erlenmeyer flask. The solution was then kept in dark condition at 29±1 °C under continuous shaking at 200 rpm for 72 h. After 72 h of reaction time the colour change was observed [20-23].

### Characterization of prepared nanoparticles via UV-absorption spectra and Transmission electron microscopy (TEM)

The formation of AgNPs and TR-AgNPs by the bioreduction of Ag<sup>+</sup> to Ag<sup>0</sup> was easily monitored using UV-Vis spectroscopy. The scanning was performed in the range of 200–700 nm. The morphology and size were determined by TEM [24-28].

### Determination of antimicrobial activity of *Trichoderma*-Ag\* fused nanoparticles against the pathogens

The antimicrobial activity of *Trichoderma* extract and *Trichoderma* fused silver nanoparticles was determined at different concentrations against local isolated pathogenic cultures viz. *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Micrococcus luteus*, *Leuconostoc mesenteroides*, *Aspergillus niger* and *Aspergillus ochraceus* by well diffusion method [29].

## III. RESULTS AND DISCUSSION

### Isolation of *Trichoderma* species from soil samples

The present study showed the isolation and characterization of *Trichoderma* spp. culture isolated from soil. Further the culture was determined taxonomically and was determined as *Trichoderma harzianum* and was denoted as per the accession no- NCFT.9153.17. The culture photograph is shown in **Figure 1**.

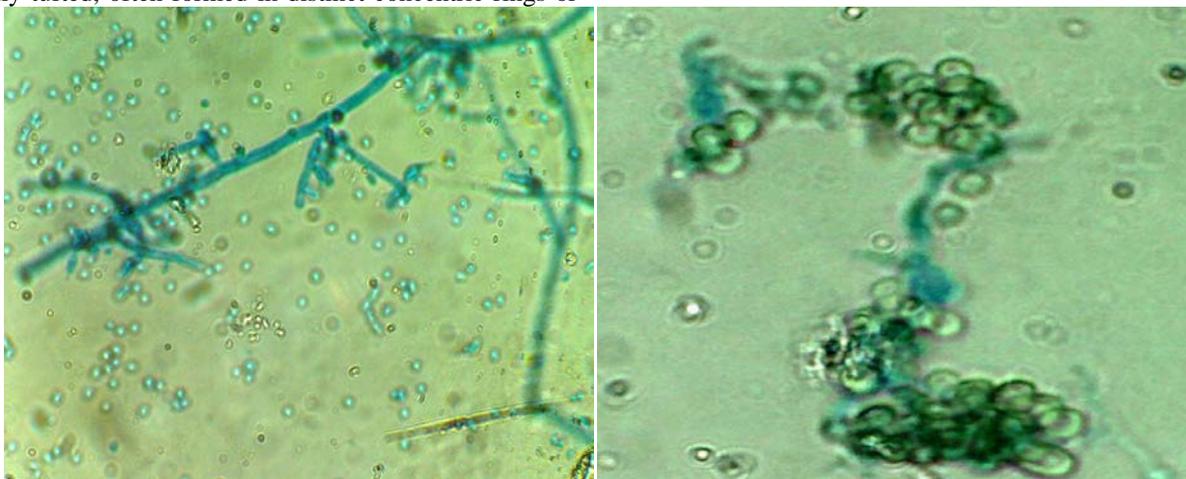


**Figure 1: Isolated Trichoderma cultures**

### Microscopic and taxonomic identification of Trichoderma culture

The colony color was initially watery white and turned bright green to dark green and dull green with compact conidiophores throughout the petriplates. Mycelium were not typically obvious on CMD, [conidia](#) typically form within one week in compact or loose tufts in shades of green or yellow or less frequently white. A yellow pigment may be secreted into the agar, especially on PDA. Septate hyaline hyphae were determined. Conidiophores were found to be hyaline, branched phialides were hyaline, flask-shaped, and inflated at the base. The colour of the conidia was mostly green. The colony produces a characteristic sweet or 'coconut' odor. Conidiophores were highly branched and thus difficult to define or measure, loosely or compactly tufted, often formed in distinct concentric rings or

borne along the scant aerial hyphae. Main branches of the conidiophores produce lateral side branches the longest branches distant from the tip and often phialides arising directly from the main axis near the tip. The branches were branched, with the secondary branches often paired and longest secondary branches being closest to the main axis. All primary and secondary branches arise at or near 90° with respect to the main axis. The typical *Trichoderma* conidiophore, with paired branches assumes a pyramidal aspect. [Phialides](#) were typically enlarged in the middle but may be cylindrical or nearly [subglobose](#). Phialides were held in whorls, at an angle of 90° with respect to other members of the whorl. Phialides were densely clustered on wide main axis. The culture was identified as *Trichoderma harzianum*. The microscopic slide images are shown in **Figure 2**.



**Figure 2: Conidia and spores in *Trichoderma harzianum***

### Preparation and extraction of the filtrate

*Trichoderma* extracts were prepared and filtered. Further solvent extraction was performed in order to determine the presence of secondary metabolites if any. The solvent extract was

further vacuum dried in order to evaporate the solvent and to obtain the powder having secondary metabolites for further identification and preparation of nanoparticles in fusion with silver. The results are shown in **Figure 3**.



Figure 3: Preparation of extract and solvent extraction of *T. harzianum*

### Preparation and characterization of Trichoderma fused silver nanoparticles (TR-Ag Nps)

In the present investigation, Trichoderma fused silver nanoparticles (TR-Ag Nps) were produced (Figure 4 and 5). The particle size was determined by SEM and their absorption spectrum was determined at 200-700 nm. It was observed that the TR-Ag Nps produced were of very fine shape and size having

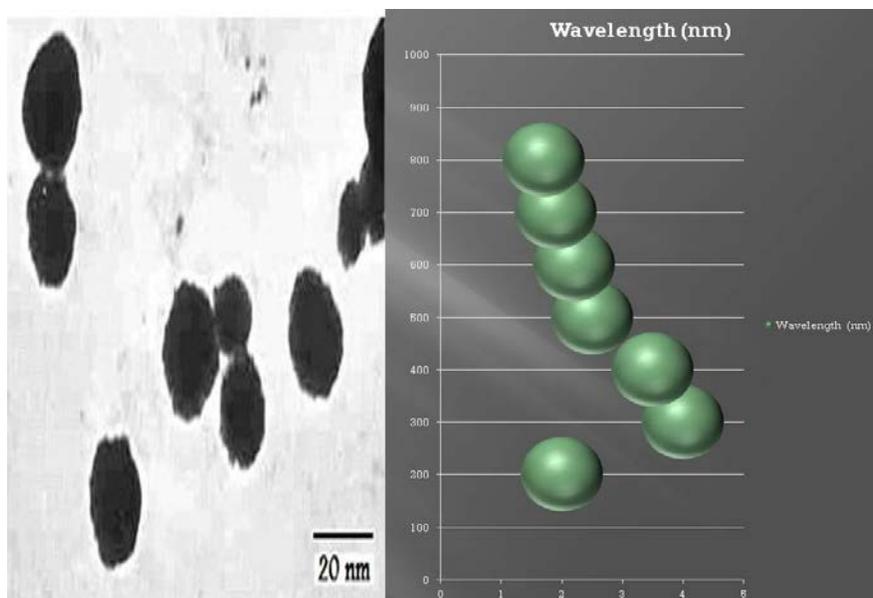
optimal 20 nm size. These nano particles were having slightly rough spherical structures which were observed in free and interconnected form (Figure 6). The UV absorption spectra of the fused nanoparticles recorded the maximum wavelength at 415 nm.



Figure 4: Preparation of silver nanoparticles



Figure 5: Preparation of Trichoderma fused silver nanoparticles (TR-Ag Nps)



**Figure 6: Characterization of TR-Ag Np by SEM and determination of absorption maxima**

**Determination of antimicrobial activity of Trichoderma solvent extract and Trichoderma-Ag\* fused nanoparticles against the pathogens**

The antimicrobial activity of Trichoderma solvent extract and Trichoderma-Ag fused nanoparticles was evaluated against the bacterial and fungal pathogens viz. *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Micrococcus luteus*, *Leuconostoc mesentroides*, *Aspergillus niger* and *Aspergillus ochraceous* by well diffusion method. The results were found to be surprising as both Trichoderma solvent extract and TR-Ag fused nanoparticles were having significant antimicrobial activity against the pathogens studied. The antimicrobial activity of Trichoderma solvent extract was determined at 10 µl, 20µl, 5 ppm, 10 ppm, 25ppm and as such (1000 µl) while antimicrobial activity of Trichoderma fused silver nanoparticles (TR-Ag Np) was determined at 20 µl, 50µl, 5 ppm, 10 ppm, 25ppm and as such (1000 µl). The results of both were found to be in correlation as at ppm level doses, none of the tests viz. Trichoderma solvent

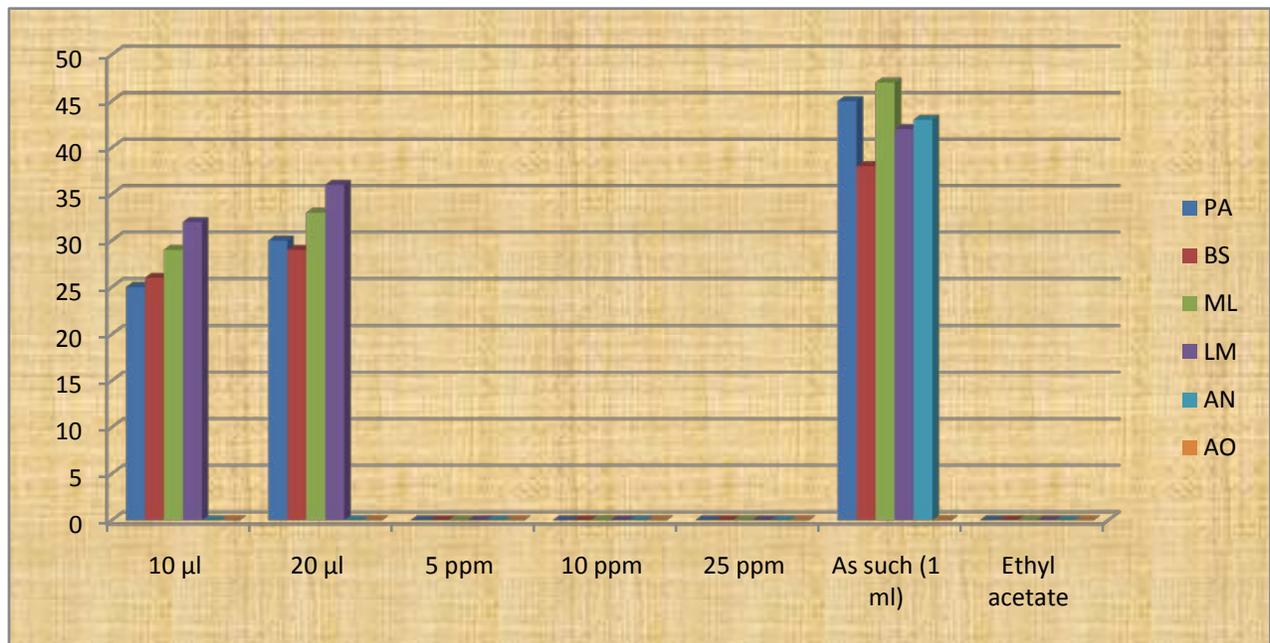
extract and Trichoderma fused silver nanoparticles (TR-Ag Np) showed any antimicrobial activity. Also no antifungal activity of each of these was found against *Aspergillus niger* and *Aspergillus ochraceous* at small doses but at 1000 µl were found to be effective against *Aspergillus niger*. The results of antimicrobial activity of Trichoderma extract are shown in **Table 1; Figures 7 (a) & (b)** while that of Trichoderma fused silver nanoparticles are shown in **Table 2; Figures 8 (a) & (b)**.

**Table 1: Antimicrobial activity of solvent extracts of Trichoderma**

Trichoderma solvent extract	Diameter of zone of inhibition (mm)					
	PA	BS	ML	LM	AN	AO
10 µl	25.0	26.0	29.0	32.0	NA	NA
20 µl	30.0	29.0	33.0	36.0	NA	NA

<b>5 ppm</b>	NA	NA	NA	NA	NA	NA
<b>10 ppm</b>	NA	NA	NA	NA	NA	NA
<b>25 ppm</b>	NA	NA	NA	NA	NA	NA
<b>As such (1 ml)</b>	45.0	38.0	47.0	42.0	43.0	NA
<b>Ethyl acetate</b>	NA	NA	NA	NA	NA	NA

\*NA, No activity; PA, *Pseudomonas aeruginosa*; BS, *Bacillus subtilis*; ML, *Micrococcus luteus*; LM, *Leuconostoc mesentroides*; AN, *Aspergillus niger*; AO, *Aspergillus ochraceous*



**Figure 7 (a): Antimicrobial activity of solvent extracts of Trichoderma**

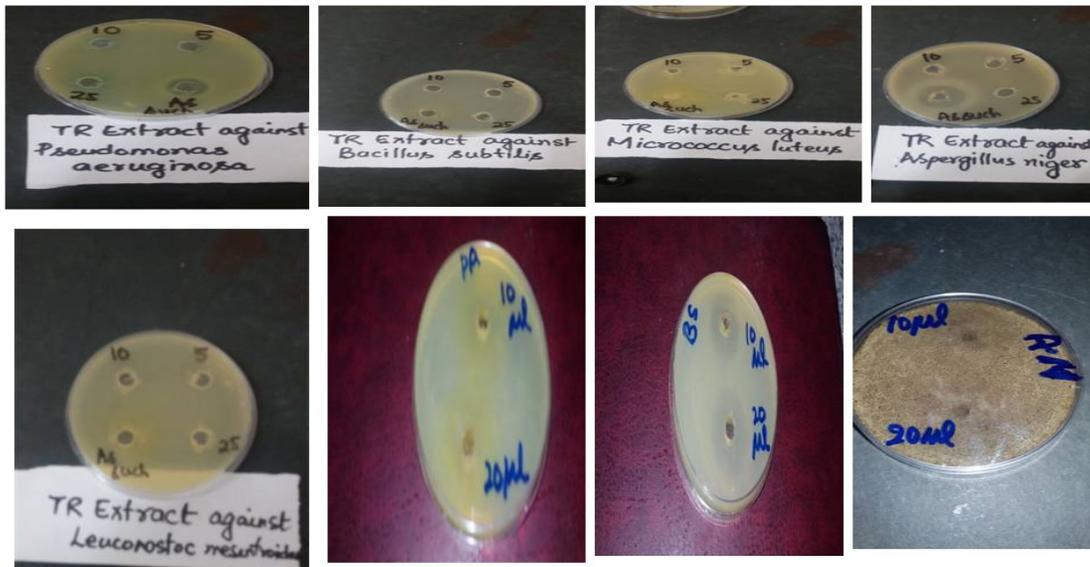
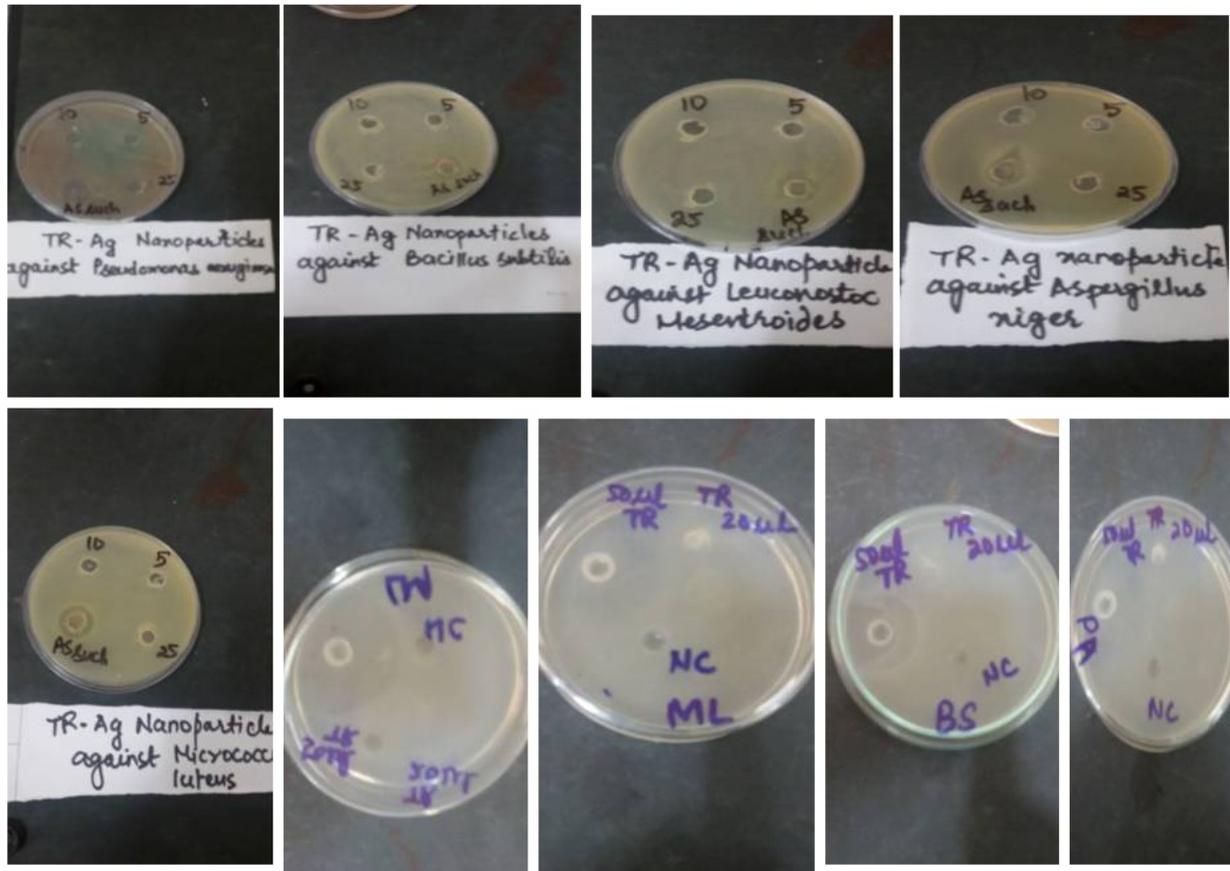


Figure 7 (b): Antimicrobial activity determination by well diffusion method of solvent extracts of Trichoderma

Table 2: Antimicrobial activity of solvent extracts of Trichoderma fused silver nanoparticles (TR-Ag Np)

Trichoderma-Ag* nanoparticles	fused	Diameter of zone of inhibition (mm)					
		PA	BS	ML	LM	AN	AO
20 µl		40.0	37.0	39.0	39.0	NA	NA
50 µl		54.0	52.0	45.0	46.0	NA	NA
5 ppm		NA	NA	NA	NA	NA	NA
10 ppm		NA	NA	NA	NA	NA	NA
25 ppm		NA	NA	NA	NA	NA	NA
As such (1 ml)		57.0	58.0	49.0	48.0	48.0	NA
N-saline		NA	NA	NA	NA	NA	NA

Figure 8 (a): Antimicrobial activity of solvent extracts of Trichoderma fused silver nanoparticles (TR-Ag Np)



**Figure 8 (b): Antimicrobial activity determination by well diffusion method of Trichoderma fused silver nanoparticles (TR-Ag Np)**

*Trichoderma* is known as an important and significant bio-control agent. The classical mechanisms of control have included antibiosis, mycoparasitism, and competition for nutrients. The significant combination of *Trichoderma* with synthetic salts/metallic ions can be utilized in treatment of different infections within the plants and animals both. These can be utilized as alternatives to different antibiotics etc. The present study thus concludes that, *Trichoderma* secretes some potent secondary metabolites responsible for antimicrobial activity against opportunistic and nosocomial infections causing pathogens. Both *Trichoderma* (biological) and silver (Inorganic metallic ions) are known to have significant antimicrobial potency. But fusions of both the biological and inorganic metallic ion have not been studied. The production of fused nanoparticles is a first kind of study done ever to determine the antimicrobial spectrum against opportunistic pathogens. Previous studies reported by our group have already described the antifungal behavior of *Trichoderma* fused silver nanoparticles against fungal phyto-pathogens [30].

#### IV. CONCLUSION

The combination of secondary metabolites from *Trichoderma* and Ag ions in terms of fused nanoparticles can

results in preparation of potent antimicrobial agents. The study may thus lead to the isolation and identification of significant antimicrobial molecule (s) from *Trichoderma* which can be utilized in preparation of different types of nanoparticles. These nanoparticles can thus be utilized as a potent biocide against pathogens. However, further study is required to isolate and characterize the secondary metabolites from *Trichoderma* solvent extract and to determine the antimicrobial behavior of the same against other pathogenic and drug resistant microbes.

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# Assessment of genetic divergence of *Costus speciosus* genotypes using RAPD marker

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**Abstract-** The present work assessed the genetic divergence among the genotypes of *Costus speciosus* collected from five blocks of Balaghat district of M.P., India by RAPD (Randomly Amplified Polymorphic DNA) using Seventeen random declaimer primers as the plant was found to adored its therapeutic efficacy in Ayurveda and traditional system of medicines and is most important medicinal plants used in Arthritis. A deprogram was constructed for cluster analysis using an un-weighted pair group method with arithmetic means (UPGMA) grouped the genotypes into 2 major clusters based on win boot. Out of the seventeen random primers used for studying genetic divergence, twelve primers were found to be polymorphic. Out of 17 primers, 1 was found to be 100% polymorphic generating a total of 21 alleles with an average of 4.2 products per polymorphic primer. The total numbers of alleles were amplified 393 and percent polymorphic was 43.36 for tall seventeen markers. Genetic similarity/dissimilarity among genotypes was evaluated by generating a similarity matrix based on Jaccard's co-efficient ranging from 56 to 0.70. Results showed that both environmental and genetic factors were constrained in observing variations. The degree of genetic variations detected among the accessions of *Costus speciosus* suggested that RAPD marker advent seemed to be best suited for assessing with high accuracy the genetic relationships among distinct *Costus speciosus* accessions.

**Index Terms-** RAPD, Genetic diversity, *Costus speciosus*, variation, Polymorphism, Primer.

## I. INTRODUCTION

Medicinal plants have been of great importance in human culture to meet the primary health care needs. Many people in developing countries use medicinal plants as traditional drugs. According to World Health Organization, up to 80% of the world's population relies on traditional medicinal system for some aspect of primary health care [1].

Medicinal plants produce a variety of compounds having known therapeutic properties. [2]. India is a varietal emporium of medicinal plants and is one of the richest countries in the world in regard to genetic resources of medicinal plants. It exhibits a wide range of topography and climate, which has bearing on its vegetation and floristic composition. Moreover, the agro-climatic conditions are conducive for introducing and domesticating new exotic plant varieties [3].

*Costus speciosus* (Koen ex. Retz.) Sm. belongs to the family Zingiberaceae comprises 175 species in all over the

world. It is commonly called Creep ginger. It can grow up to 5ft. tall in frost-free areas, but typically grow to about 6 ft. tall in cooler regions. In India *Costus speciosus* alone widely distributed at Western Ghats of Tamilnadu and some other moist places of India. The plant is mainly used for healing in burning sensation, constipation, leprosy, worm infection, skin diseases, fever, asthma, and bronchitis. The leaf infusion is used by the patients while bathing with high Febrifuge [4]. It is an erect plant up to 2.7 m high with tuberous root stalk, a sub-woody stem at the base flowers are larger, white, in thick, cone like terminal spikes, with bright red bracts. *Costus speciosus* is native to the Malay peninsula of the south-east Asia. In India, the plant naturalizes in sub-Himalayan tract of central India and parts of Western Ghats of Maharashtra, Karnataka and Kerala [5].

Madhya Pradesh is a second largest state of India. The state is the home of many tribal's such as Baigas, Gonds, Korku tribes[6]. Madhya Pradesh is the heart of Indian Peninsula and has largest concentration for tribal population, about 28% of the total state's population. Madhya Pradesh has different types of growing healing herb, which is used in arthritic medicine like Ayurveda, Siddha and Unani. Medicinal and aromatic plants found in forest areas throughout the Madhya Pradesh form the plain to the hills.

Molecular markers are DNA sequences that are randomly present throughout the DNA and shows specific location in the genome. Molecular markers are of many types but we use RAPD marker. Markers in combination with morphological characterization can be used to evaluate genetic variation among different species of plants. RAPD is a reliable and specific marker in which two orbitatory primers are used which randomly selects and gives results in the form of polymorphism. Due to advancement in plant biology our researchers focuses on the study of molecular characterization of genetic analysis of medicinal plant used in the treatment of arthritis. Molecular characterization in plant biology is used to study to molecular genetic data, molecular biology experimentation, and system analysis. Molecular markers are DNA sequences that are randomly present throughout the DNA and shows specific location in the genome. Molecular markers are of many types but we use RAPD marker. Markers in combination with morphological characterization can be used to evaluate genetic variation among different species of plants. RAPD is a reliable and specific marker in which two orbitatory primers are used which randomly selects and gives results in the form of polymorphism.

## II. MATERIALS AND METHODS

### Plant material

A total of five genotypes were collected from genotypes of *Costus speciosus* collected from five blocks of Balaghat district of M.P., India. The Genotype name their collection sites are given in Table 1.

**Table 1: Five genotypes of *Costus speciosus* and their collection sites**

S. No	Place of collection	Latitude	Longitude	Altitude (m)
1.	Block Birsa (Kaniya)	21 <sup>o</sup> 50` N	080 <sup>o</sup> 50` E	606 m
2.	Block Baihar (Pathri)	21 <sup>o</sup> 20` N	080 <sup>o</sup> 42` E	497 m
3.	Block Parswada (Geegali ghoghara)	22 <sup>o</sup> 09` N	080 <sup>o</sup> 14` E	524 m
4.	Block Balaghat (Gangulpara)	21 <sup>o</sup> 53` N	080 <sup>o</sup> 18` E	374 m
5.	Block Lanji (Devarbeli)	21 <sup>o</sup> 37` N	080 <sup>o</sup> 39` E	357 m

### DNA isolation, amplification and data analysis

The leaf tissue (500 mg) was collected and total genomic DNA was isolated from this leaf tissue sample by following the protocol of **Doyle and Doyle (1987)**[7] with some minor modifications Fig.1. The leaf tissue was powdered in liquid nitrogen and immediately transferred to 50 ml polypropylene tubes containing 15 ml of preheated (65°C) extraction buffer. DNA quantity and quality was evaluated spectrophotometrically using a Nano-Drop spectrophotometer Table 2. DNA amplification was carried out in an Eppendorf Master-cycler gradient using 10-mer RAPD primers obtained from Integrated DNA Technologies, USA. 50 ng of genomic DNA was used for each PCR amplification reaction. Each PCR reaction of 20 µl reaction volumes contained 1X PCR buffer, 1.5 mM MgCl<sub>2</sub>, 200 µM dNTP mixes, 10 pmol of primer (Integrated DNA Technologies, USA) and 1U of Taq polymerase. All the chemicals used in the PCR reaction were procured from **(Bangalore Genei, India)** unless otherwise stated. Amplification conditions were: initial denaturation of 5 min at 95°C followed by 45 cycles each of 1 min at 94°C, 1 min at 35°C and 2 min at 72°C and finally a 8 min extension at 72°C. All the experiments were repeated twice to ensure reproducibility. Amplified DNA fragments were separated by electrophoresis at 100 V in 1 X TAE for 3 hrs on 1.2% agarose gel. Gels were stained with ethidium bromide and photographed by the gel documentation system **(Bio-Rad)**.



**Fig. 1 Genomic DNA of Five genotypes of *Costus speciosus***

**Table 2: Genomic DNA quantification**

S. No.	Place of collection	Ratio 260/280	DNA Con. (ng/ul)
01	Birsa (L <sub>1</sub> )	1.75	500
02	Baihar (L <sub>2</sub> )	1.78	800
03	Parswada (L <sub>3</sub> )	1.69	1000
04	Balaghat (L <sub>4</sub> )	1.88	500
05	Lanji (L <sub>5</sub> )	1.89	1200

### Analysis of RAPD data

Amplified fragments were scored for the presence (1) and absence of (0) bands. The data matrices were analyzed by the SIMQUAL program of NTSYS-pc (**ver. 2.02e**)[8] and the similarities between genotypes were estimated using Jaccard's coefficient. A dendrogram was constructed from the resultant similarities matrices using the unweighted pair group mean averages (UPGMA) method [9]. Statistical analysis was performed in the program PAST3 [10].

## III. RESULTS AND DISCUSSION

Genetic variability in *Costus speciosus* in five blocks of Balaghat district has been carried out using RAPD markers. Seventeen primers generated reproducible, informative and easily scorable RAPD profiles (**Table 3 & Fig. 2 to Fig. 11**).

The number of alleles was amplified ranged from 3 to 9. A total 393 alleles were amplified with average 23.17 alleles per primer. Out of 393, 170 polymorphic bands were observed. The same type of bands occurred at different frequencies in all populations. There were many additional bands neglected which were not reproducible. Seventeen different RAPD primers (primer-01, primer-02, primer-03, primer-04, primer-05, primer-06, primer-07, primer-08, OPA-12, OPY-11, OPB-04, OPD-01, OPE-01, OPG-4, OPM-16, OPB-11 and OPT-01) were used to evaluate the level of genetic diversity amongst the different samples of *Costus speciosus*. The amplified product was scored on the basis of presence and absence of bands. The scoring of

bands was done independently and only the distinct well separated bands were used to generate the input 1, 0 matrixes that were used for all further computations. A total of 392 bands were amplified in five *Costus speciosus* samples using 17 RAPD primers. Out of these 392 bands, 170 bands were polymorphic and 223 bands were monomorphic (**Table 2**). Maximum

numbers of bands were generated from the primer OPT-01 giving 34 bands out of which 09 were polymorphic, followed by primer OPG-04 generating 31 bands with 06 polymorphic bands. A 100% polymorphism was obtained with the primers OPE-01 and followed by primer OPY-11 (90.47).

**Table 3: List of the RAPD markers used for this study**

So.No	Primer code	Nucleotides sequence (5`-3`)	Annealing temperature (T <sub>m</sub> )	Size of fragment (bps)	TNB	PB	MB	PP	PIC
1	Primer 1	TCTGTGCCAC	34.9 <sup>0</sup> C	75-1kp	18	8	10	44.44	0.5
2	Primer 2	GTGTGCCCAA	35.9 <sup>0</sup> C	75 -400bp	17	12	5	70.59	0.47
3	Primer 3	GACTAAGCCC	30.6 <sup>0</sup> C	50 -500bp	19	14	5	73.68	0.52
4	Primer 4	TCCCCATCAC	32.8 <sup>0</sup> C	50 -500bp	14	9	4	64.29	0.38
5	Primer 5	AATCGGGCTG	35.1 <sup>0</sup> C	200-900bp	24	9	15	37.50	0.66
6	Primer 6	CAAACGTCGG	34.2 <sup>0</sup> C	200-900bp	21	6	16	28.57	0.52
7	Primer 7	GTTGCGATCC	33.5 <sup>0</sup> C	100-900bp	26	6	20	23.08	0.72
8	Primer 8	GTAGACCCGT	32.6 <sup>0</sup> C	200-800bp	16	11	5	68.75	0.44
9	OPA-12	TCGGCGATAG	36.7	200-550bp	16	11	5	68.75	0.44
10	OPY-11	AGCGTGTCTG	32.8	200-500bp	21	19	2	90.48	0.58
11	OPB-4	GGACTGGATG	24.6	200-800bp	32	2	30	6.25	0.88
12	OPD-1	ACCGCGAAGG	44.1	200-800bp	30	10	20	33.33	0.83
13	OPE-1	CCCAAGGTCC	37.3	200-500bp	21	21	0	100.00	0.58
14	OPG-4	AGCGTGTCTG	29.2	200-900bp	31	6	26	19.35	0.1
15	OPM-16	GTAACCAGCC	32	200-900bp	30	15	15	50.00	0.88
16	OPB-11	GTAGACCCGT	32	200-500bp	22	2	20	9.09	0.61

17	OPT-1	GGGCCACTCA	32	100-900bp	34	9	25	26.47	0.8
<b>Total</b>					<b>393</b>	<b>170</b>	<b>223</b>	<b>43.36</b>	

The clear bands were scored from the gel and “0” and “1” were standardized as the least and maximum of dissimilarity respectively. The dissimilarity coefficients used for cluster analysis was based on the unweighted neighbor- joining method and a dendrogram was generated to study the relationship among *Costus speciosus* samples collected from different regions of Balaghat district (M.P.). The genetic dissimilarity index calculated varied from 0.07 to 0.60 for all the five costus samples (Table 3). The maximum genetic diversity i.e. 0.60 was

calculated for samples **collected from Baihar (L2) and Lanji (L5)**. This shows that the *Costus speciosus* samples collected from these two places are highly genetically diverse. The sample L2 and L4 collected from **Baihar (L2) and Balaghat (L4)** respectively do not show much diversity (0.07). This clearly indicated that these two samples may have same genetic makeup with no or very little genetic difference and these may have spread to different areas because of human intervention.

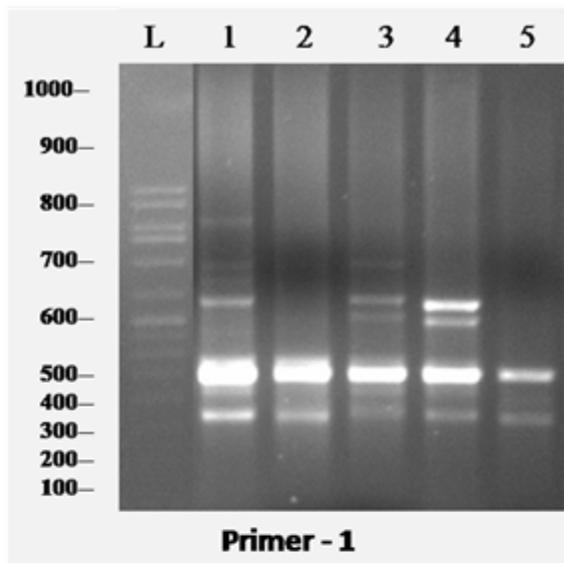


Figure 2: Gel picture showing the RAPD amplification patterns generated by Primer 1 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanjil.]

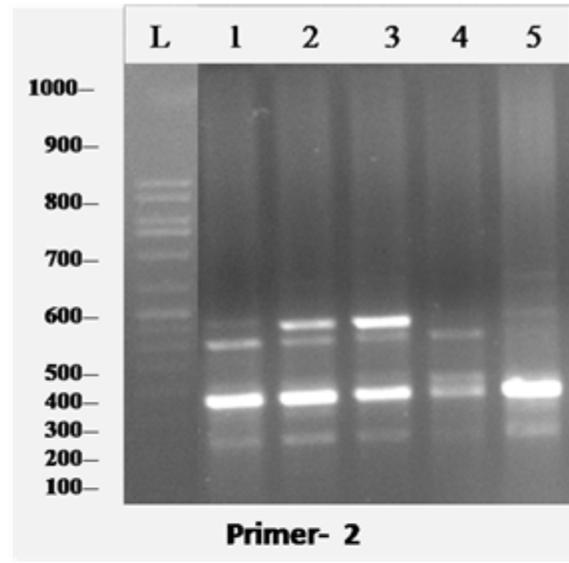


Figure 3: Gel picture showing the RAPD amplification patterns generated by Primer 2 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanjil.]

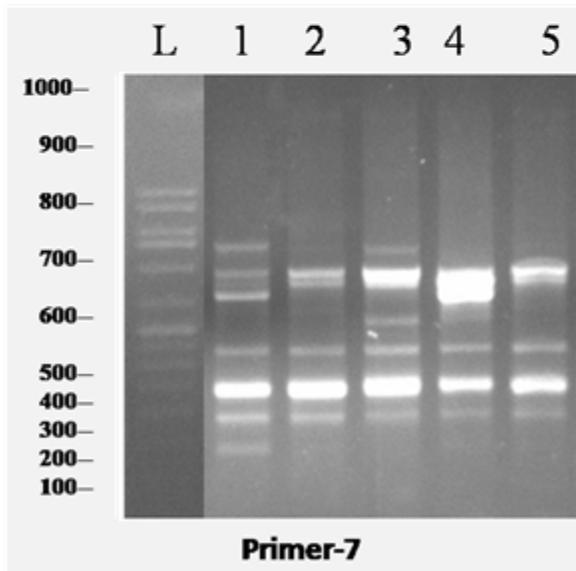


Figure 4: Gel picture showing the RAPD amplification patterns generated by Primer 7 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanjil.]

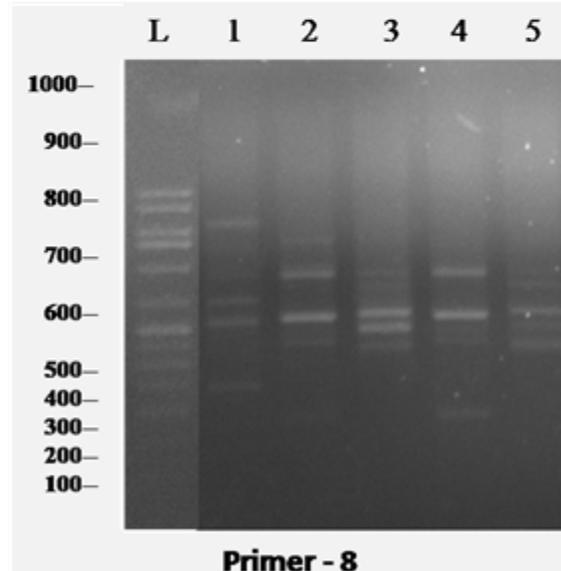


Figure 5: Gel picture showing the RAPD amplification patterns generated by Primer 8 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanjil.]

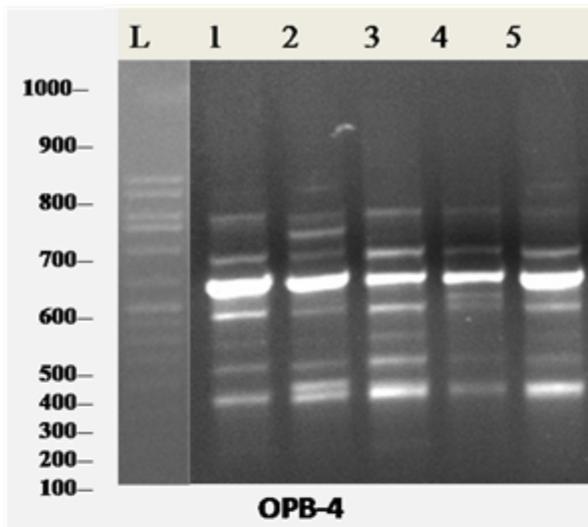


Figure 6: Gel picture showing the RAPD amplification patterns generated by Primer OPB-4 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanji.]

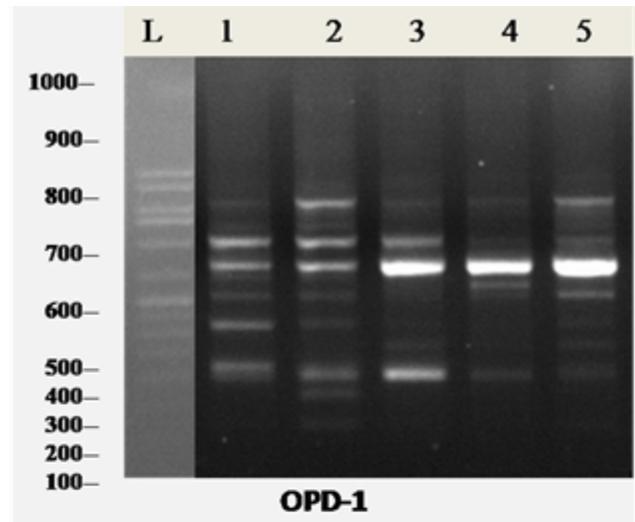


Figure 7: Gel picture showing the RAPD amplification patterns generated by Primer OPD-1 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanji.]

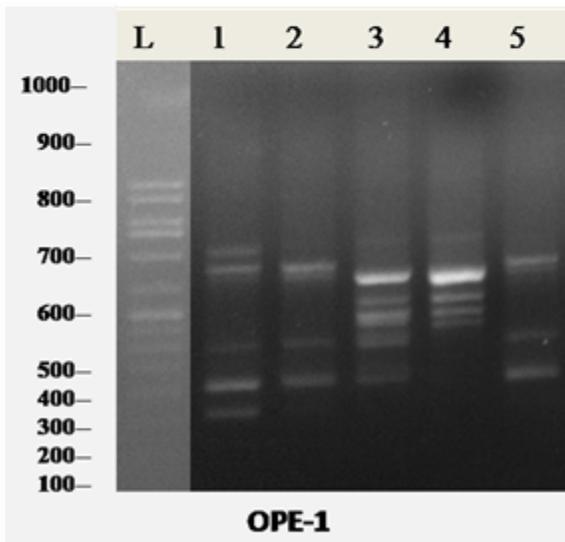


Figure 8: Gel picture showing the RAPD amplification patterns generated by Primer OPE-1 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanji.]

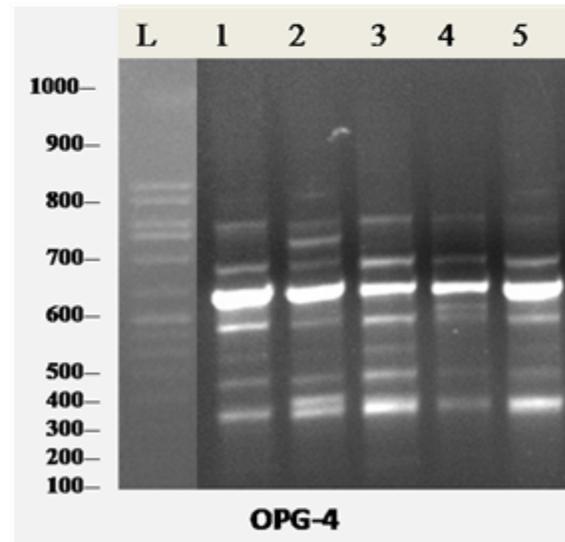


Figure 9: Gel picture showing the RAPD amplification patterns generated by Primer OPG-4 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanji.]

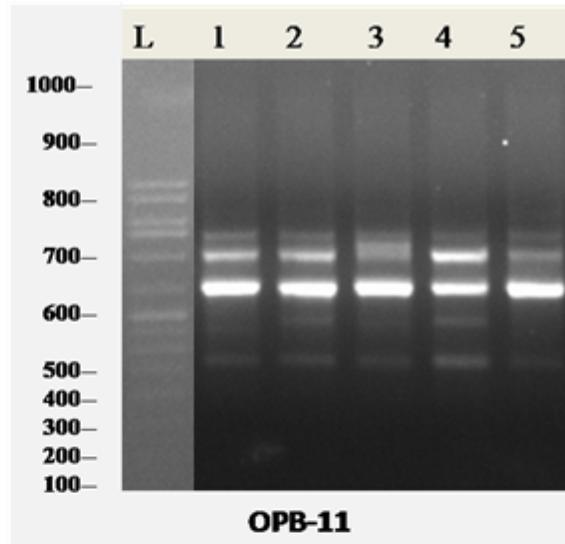
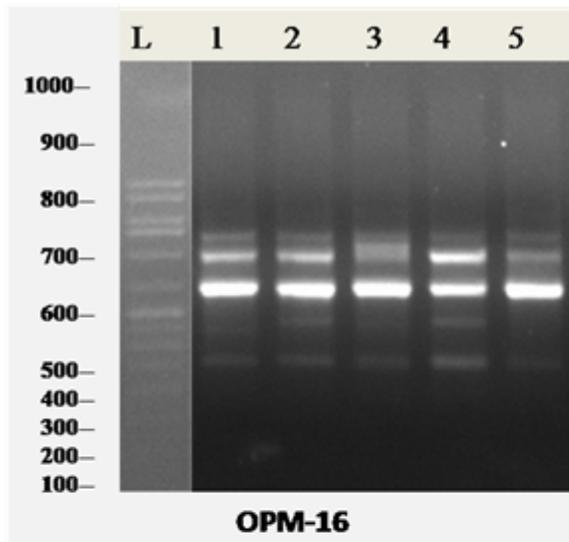


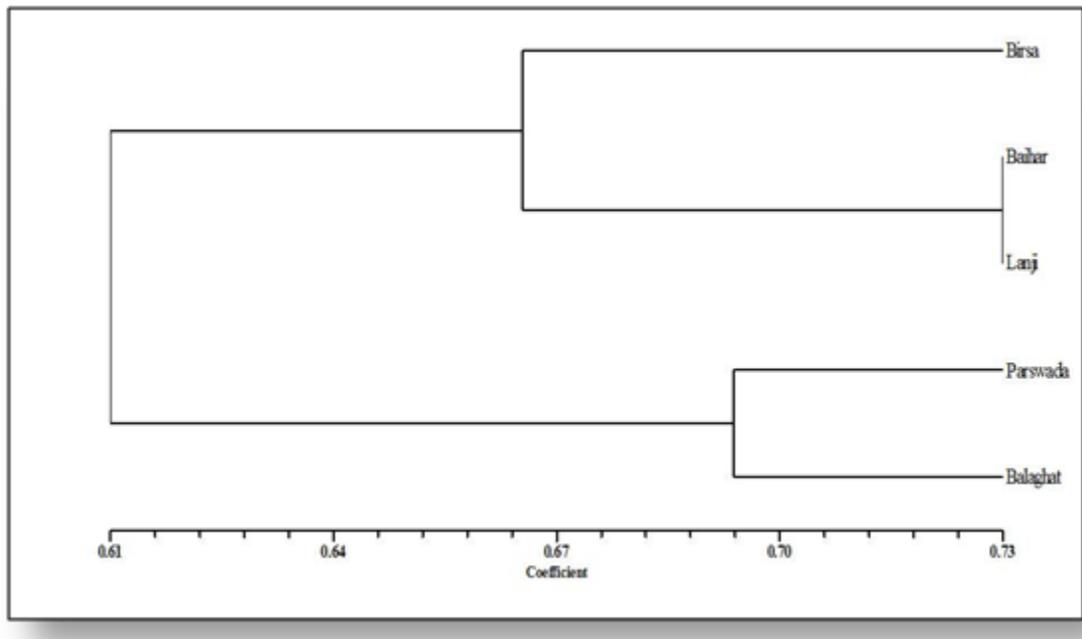
Figure 10: Gel picture showing the RAPD amplification patterns generated by Primer OPM-16 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanji.]

Figure 11: Gel picture showing the RAPD amplification patterns generated by Primer OPB-11 [L-Ladder, Names of Samples: 1-Birsa; 2- Baihar; 3- Parswada; 4- Balaghat; 5- Lanji.]

Table Analysis of genetic dissimilarity:

	L1	L2	L3	L4	L5
L1	1.00				
L2	0.28	1.00			
L3	0.27	0.17	1.00		
L4	0.07	0.20	0.44	1.00	
L5	0.51	0.60	0.51	0.38	1.00

L1-Birsa, L 2 - Baihar, L 3 - Parswada, L 4 - Balaghat, L5 - Lanji



**Figure 1: UPGMA based dendrogram of five *Costus speciosus* samples**

The generated dendrogram based on neighbourhood joining method approach of the UPGMA method showed three distinct clusters (Fig 1). All five genotypes were classified into two cluster; cluster 1 and cluster 2. The genetic similarity between all five genotypes ranged from 61% to 73%. Cluster 1 has three genotypes which were collected from Birsa, Baihar and Lanji and showed around 66% similarity between each other. The highest similarity was observed between Baihar and Lanji and that was 73%. Cluster 2 and only two genotypes collected from Parswada and Balaghat and showed around 69% similarity to each other.

Nowadays DNA analysis has become routine technique to estimate genetic diversity in many plant species [11, 12 and 13, 14] including medicinal plants [15 and 16]. A large number of medicinal plant species produce different secondary metabolites which can hamper the DNA isolation procedures. Because of this fact optimization of DNA isolation protocols is often necessary as a primary step in molecular analysis of medicinal plant [17]. The first step of presented study concerned on identification of effective method of DNA isolation from fresh tissue. DNA extracted with CTAB method characterized bad purity and quality. DNA pellets were sticky and have brown or green colour. After electrophoresis in UV light many pollutants around of DNA were observed. After PCR with selected RAPD primers no amplification products were observed. In the second experiment isolated DNA characterized better purity and acceptable quality than obtained using CTAB method, but after PCR no amplification product were observed too. Because of fact that pollutants migrated in agarose gels to purify obtained DNA long and slow electrophoresis and isolation DNA from gels were used. After that procedure DNA characterized small amount but purity and quality were sufficient to conduct PCR. Second part of the experiment was estimating genetic diversity among *A. Montana* genotypes using RAPD method. Randomly amplified

polymorphic DNA is a technique, which identified relatively high number of polymorphic products [18 and 19].

#### IV. CONCLUSIONS

Presented experiment showed that isolation of pure DNA from *A. montana* plants is very difficult. The good way to obtain good quality of DNA is using long and slow electrophoresis and isolation of DNA from agarose gels. Present study demonstrated that RAPD markers provide a useful and effective method to estimate the genetic diversity among *A. montana* genotypes. Analyzed *A. montana* genotypes characterized quite high genetic similarity. The highest genetic similarity was estimated among GA17 and GA18 genotypes, which were closely located on the obtained dendrogram.

**Conflict of interest:** Hari Shankar Yadav and P.K. Saluja declare that they have no conflict of interest.

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# Power Quality Enhancement by PI Controller through Distributed Particle Swarm Optimization using STATCOM

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**Abstract**-The power quality resources have continuously played an important role in the growth of human livings. PSO tuned PI controller are compared and a mark reduction in total harmonic reduction is with number of generations. PI Controller distributed Generation units that encompass a portion of an electric power distribution system and may rely on different energy sources. Functionally, the PI controller is required to provide adequate levels and quality of power to meet load demands. The issue of power quality is significant as it directly affects the characteristics of the PI controller operation. This problem can be defined as an occurrence of short to long periods of inadequate or unstable power outputs by the PI controller. In a stand-alone operation mode, the system voltage and frequency must be established by the PI controller; otherwise the system will collapse due to the variety in the PI controller component characteristics. In our proposed scheme is to define the global and local best fitness for the STATCOM in order to improve power quality and minimize power losses in the grid with PI controller and RLC branch, using Particle Swarm Optimization algorithm and we also comparing with base Genetic algorithm which implement programming and Simulink design in MATLAB tool.

**Keywords**-Distribution Static Synchronous Compensator, Instantaneous Reactive Power

Theory, Total Harmonic Distortion, Particle Swarm Optimization, Proportional Integral

## Introduction

The particle swarm optimization (PSO) is a computational method that optimizes a problem by iteratively trying to improve a candidate solution with regard to a given measure of quality. It solves a problem by having a population of candidate solutions, here dubbed particles, and moving these particles around in the search-space according to simple mathematical formulae over the particle's position and velocity. The algorithm was simplified and it was observed to be performing optimization. The book by Kennedy and Eberhart describes many philosophical aspects of PSO and swarm intelligence.

Let  $S$  be the number of particles in the swarm, each having a position  $x_i \in \mathbb{R}^n$  in the search-space and a velocity  $v_i \in \mathbb{R}^n$ . Let  $p_i$  be the best known position of particle  $i$  and let  $g$  be the best known position of the entire swarm. A basic PSO algorithm is then:

for each particle  $i = 1, \dots, S$  do

    Initialize the particle's position with a uniformly distributed random vector:  $x_i \sim U(b_{lo}, b_{up})$

    Initialize the particle's best known position to its initial position:  $p_i \leftarrow x_i$

    if  $f(p_i) < f(g)$  then

        update the swarm's best known position:  $g \leftarrow p_i$

    Initialize the particle's velocity:  $v_i \sim U(-|b_{up} - b_{lo}|, |b_{up} - b_{lo}|)$

While a termination criterion is not met do:

Foreach particle  $i = 1, \dots, S_{do}$

foreach dimension  $d = 1, \dots, n_{do}$

Pick random numbers:  $r_p, r_g \sim U(0,1)$

Update the particle's velocity:  $v_{i,d} \leftarrow \omega v_{i,d} + \phi_p r_p (p_{i,d} - x_{i,d}) + \phi_g r_g (g_{d} - x_{i,d})$

Update the particle's position:  $x_i \leftarrow x_i + v_i$

iff( $x_i$ ) < f( $p_i$ ) then

Update the particle's best known position:

$p_i \leftarrow x_i$

iff( $p_i$ ) < f( $g$ ) then

Update the swarm's best known position:

$g \leftarrow p_i$

The values  $b_{lo}$  and  $b_{up}$  are respectively the lower and upper boundaries of the search-space. The termination criterion can be number of iterations performed, or a solution with adequate objective function value is found.

In this Thesis Power quality enhancement by pi controller distributed particle swarm optimization (D-PSO) using statcom is analyzed. The pi controller will suffer from power quality issues. The proposed system will give better solution to the power quality issues. The D-pso is used to control scheme for to produce switching signal of STATCOM. In the proposed system the STATCOM is connected to point of common coupling with energy storage system. The control scheme of STATCOM connected to grid with energy generation system is simulated using MATLAB/SIMULINK

The main aim of this thesis is to improve the quality of the power supply in a PI controller scenario through new power control strategy based on the distributed Particle Swarm Optimization technique. In both PI controller operation modes: islanding and grid-connected, there are many types of disturbances that impact power quality. Therefore, pursuing following specific objectives should help achieve the main aim of this thesis.

1. Implementing an optimization technique for a real-time self-tuning method for the proposed power controller.

2. Controlling the PI controller voltage and frequency in the islanding operation mode.

3. Regulating the active and reactive power flows in the grid-connected operation mode, in order to halve the load between the PI controller and utility.

4. Achieving an appropriate power sharing among the (Distributed Generation) DG units in the islanding operation mode, in addition to ensuring appropriate voltage and frequency regulation.

5. Investigating the system's stability under the proposed power controller, and also examining sensitivity to the control parameters, in order to validate the proposed power controller.

## RESULTS AND DISCUSSION

In this thesis work, Simulink model test system is analyzed. In this test model two similar loads with different feeders are considered. One of the feede is connected to DSTATCOM and the other is kept as it is. This test system is analyzed under different fault conditions. System is also analyzed with non linear load under same fault conditions. The control technique implements a PI controller which starts from the difference between the injected current (DSTATCOM current) and reference current (identified current) that determines the reference voltage of the inverter (modulating reference signal).

In parameters of the system the modeled system has been tested on different fault conditions with linear as well as non linear load. The system is employed with three phase generation source with configuration of 25KV, 50 Hz. The source is feeding two transmission lines through a three phase, three windings transformer with power rating 250MVA, 50 Hz.

Winding 1:  $V_{1rms}$  (ph-ph) = 25 KV,  $R_1 = .002$  (pu),  $L_1 = .08002$  (pu).

Winding 2:  $V_{2rms}$  (ph-ph) = 11 KV,  $R_2 = .002$  (pu),  $L_2 = .08002$  (pu).

Winding 3:  $V_{3rms}$  (ph-ph) = 11 KV,  $R_3 = .002$  (pu),  $L_3 = .08002$  (pu).

The basic OPF problem can be described mathematically as a minimization of problem of minimizing the total fuel cost of all committed plants subject to the constraints.

$$\text{Minimize } \sum_{i=1}^n F_i(P_i)$$

$F(P_i)$  is the fuel cost equation of the 'i'th plant. It is the variation of fuel cost (\$ or Rs) with generated power (MW). Normally it is expressed as continuous quadratic equation.

$$F_i(P_i) = a_i P_i^2 + b_i P_i + c_i, \quad P_i^{\min} \leq$$

The total generation should meet the total demand and transmission loss. The transmission loss can be determined from power flow.

$$\sum_{i=1}^n P_i = D + P_l$$

$$P_l = \text{real}\left(\sum_j V_i Y_{ij}^* V_j\right), i = 1, 2, \dots, n$$

$$Q_l = \text{imag}\left(\sum_j V_i Y_{ij}^* V_j\right), i = 1, 2, \dots, n$$

$$V_i^{\min} \leq V_i \leq V_i^{\max}$$

(A6)

$$LF_{ij} \leq \text{Line flow limits}$$

(A7)2.

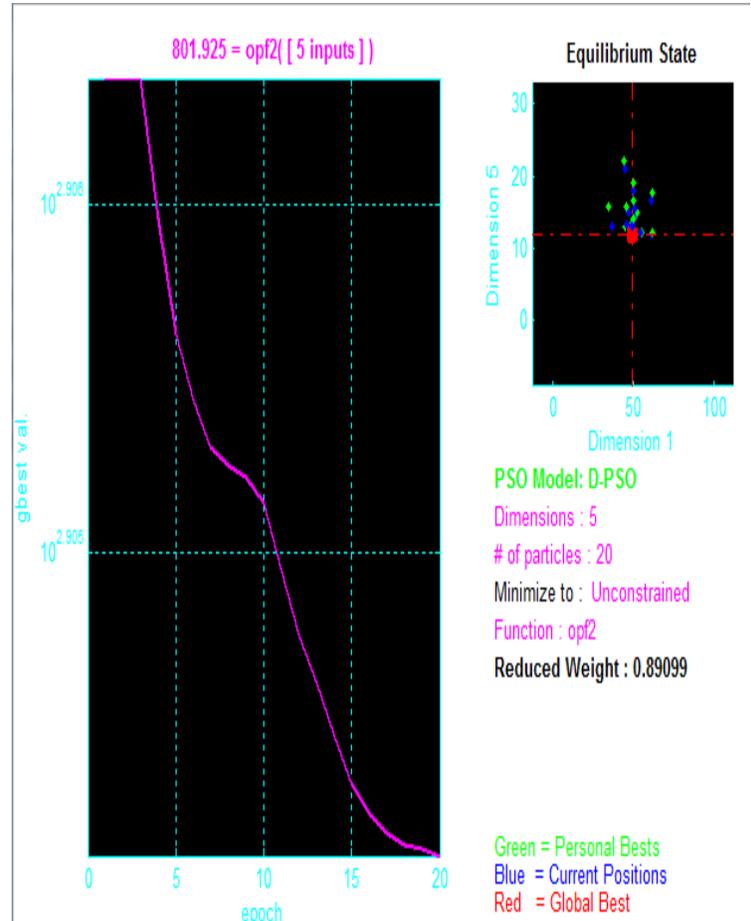


Figure 5.1: gbest value with best fitness in voltage regulation and improving weight inertia i.e 0.89099

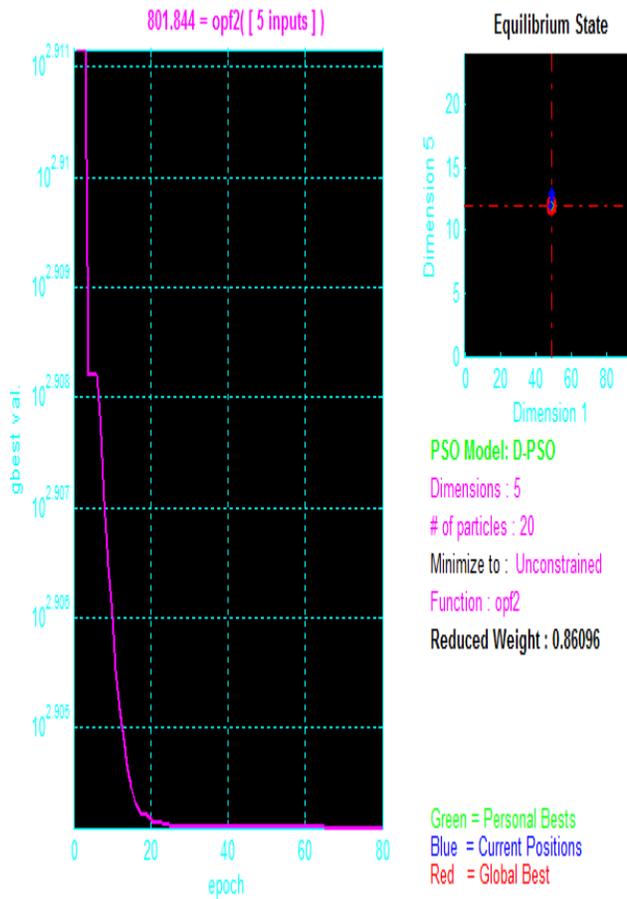


Figure 5.2: gbest value with best fitness in voltage regulation and improving weight inertia i.e 0.86096

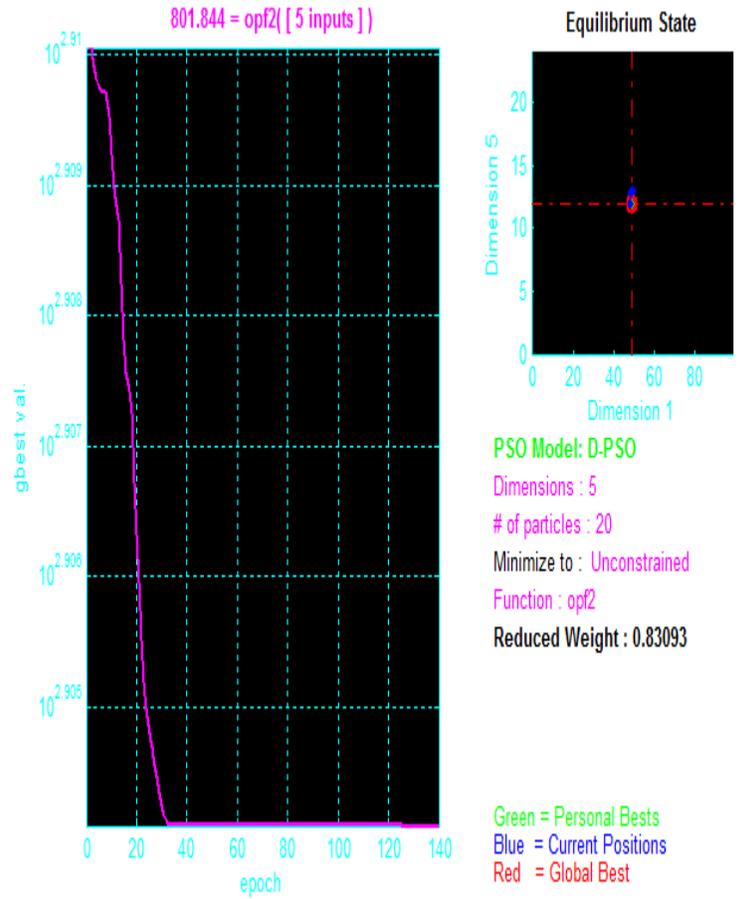


Figure 5.3: gbest value with best fitness in voltage regulation and improving weight inertia i.e 0.83093

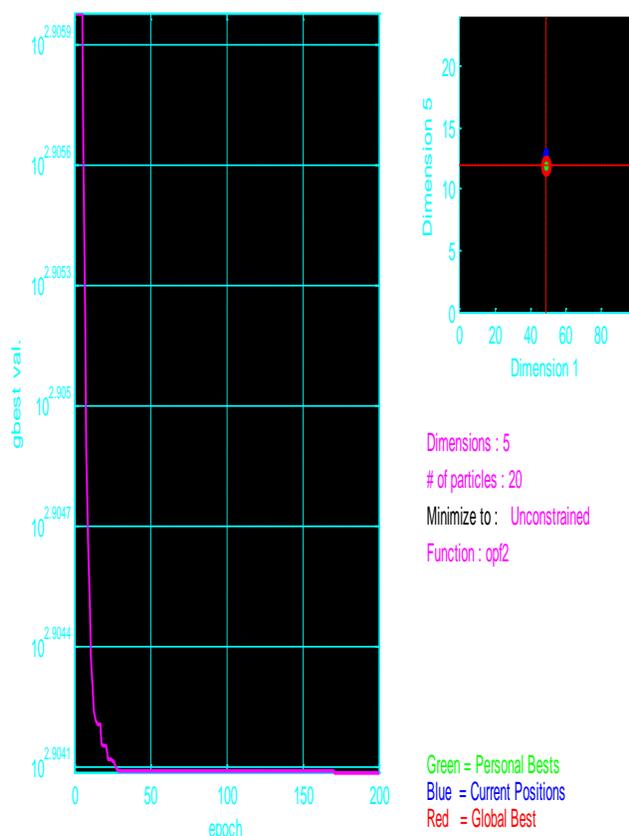


Figure 5.4 Final Improved weight with maximum coverage of voltage

### Discussion

Tuning of PI controller plays a significant role in Power electronics. There are many approaches proposed for obtaining the parameters of  $K_p$  and  $K_i$ . Based on Ziegler Nichols method of tuning the parameters of  $K_p$  and  $K_i$  were chosen. The THD value is nearly 8.38%, but the IEEE standard of THD value is less than 5% is recommended. So a new problem is formed by minimization of power and load consumption value in the time domain simulation. The samples of STATCOM in D-PSO is taken at 0.641 sec and the mean value of THD data is achieved from time domain simulation and the values are passed to D-PSO solver as objective function. The  $K_p$  and  $K_i$  values are randomly populated

and the minimization of objective function is made. The PSO gives better results compared to Ziegler Nichols method and it makes the THD value less than the IEEE standard value.

### CONCLUSION

In this work, the investigation on the role of STATCOM is carried out to improve the power quality in distribution networks with static linear and non-linear loads. PI controller is used with the device to enhance its performance. Test system is analyzed and results are presented in the previous chapter. Conditions and it can be concluded that STATCOM effectively improves the power quality in distribution networks with linear static. It would result in a power stability improvement and each STATCOM decreases a risk of critical events caused by those sources. Using STATCOM, we are able to control the voltage at the node to which this device is connected and at the same time it is possible to reduce active power losses and provides information for STATCOM design and placement in power grids. Applying Particle Swarm Optimization showed the potentials to use this method in power grids to improve their operation and selected criteria.

### FUTURE SCOPE

In this thesis work it is shown that DSTATCOM can compensate harmonics in current. The work can be expanded in the following area:  
Other advanced controllers like fuzzy controller, adaptive fuzzy controller can be employed with DSTATCOM to increase the effectiveness of DSTATCOM in distribution networks.  
Dynamic loads can be considered in future work and the effect of DSTATCOM with them can be studied

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# Challenges in Preservation and Conservation of Literary Material

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**Abstract-** The premise of the present study is to find out problems faced while preservation and conservation of literary material in Indian scenario. The idea of this study is also to identify whether the old literature has been preserved or conserved by Indian libraries in any ways and different ways to preserve and conserve library material, main problems for deterioration of print material, hindrance to effective preservation or conservation of library material.

**Index Terms-** Conservation, preservation, library material, literary heritage

## I. INTRODUCTION

Libraries in older days only keep printed material such as books, periodicals, newspaper cuttings, manuscripts, etc., but modern libraries keep other material such as paintings, drawings, charts, maps CD-ROM, DVDs, audio and video recordings, films, microfiches, microfilms, art reproductions, computer software, online database, external hard disk or server for backup and other digital material. So all the printed and non printed material of library needs preservation and conservation to make it in the readable and presentable condition and for future use.

Preservation and conservation of library heritage are very important as it could be related to social, economic, political, historical, law or religious and could be used for future purpose. Preservation and conservation of library heritage are vital so that other generations can take advantage of it. It is the duty of the head of the institution and management to draft a policy to preserve or conserve rare or old material in different ways.

Now –a- days many big libraries are taking efforts to preserve and conserve library material, but more efforts are required by other small libraries in this area also.

The idea behind applying both preservation and conservation is to safeguard library, literary heritage from harm / loss, damage, destructing / decay and maintaining it in good condition for present and future use. It is important to distinguish between preservation and conservation to understand it fully.

Preservation and conservation are commonly used interchangeably. **Preservation** means regular maintenance of library material, whereas **Conservation** means the remedial treatment and restoration of the already damaged material.

## II. LITERATURE SURVEY

The concept of preservation and conservation of literary heritage is not new. In olden days also libraries are using

binding, cleaning, pasting, etc. to preserve the printed material. So to preserve non printed material multiple some techniques like copies of CD or floppy or backup of hard disk has been done. The brief description of literature studied from 1981 to 2015 is given below. **Henderson (1981)**, describes preservation and conservation of library material by preparing a committee to examine environmental conditions, the history of previous disasters, making disaster plan, different preservation activities, creation of a comprehensive preservation program etc. **Clements (1987)** has conducted a survey and presented in detail about problems such as environmental, building, biological, change in preservation condition, handling / use by the general public. The resources available in the institution for preserving material, preservation of special documents, different properties of different documents, education and training, policy development and implementation measures, treatment options available etc. **Kademani (2003)**, presented about the BARC library preservation program. The modern library has to preserve not only traditional media of learning, but also modern media of learning such as CD-ROM, DVD, photographs, and microfilms and also adopt themselves with the changing technology and changing scenarios. **Sahoo, Jyotshna (2005)**, stated in detail about different factors responsible for deterioration of library material such as environmental, biological, chemical, human factors, disasters and also provided preventive measures against all these factors. **Adekannbi and Wahab (2015)** have conducted a survey in selected libraries of Nigeria to identify different types and frequencies of deterioration of library material, causes of deterioration of library material, preservation and conservation techniques adopted for print and non- print material from by different libraries and use of ICT in preservation and conservation of library material.

## III. DIFFERENT WAYS TO PRESERVE AND CONSERVE LIBRARY MATERIAL

The library material can be conserved in different ways such as physical, chemical, photocopying / reprographic and digital conversation.

- i. **Physical Conversation:** Mending, repairing and binding, cleaning and dusting, shelving library material for the free flow of air, lamination, installing air-conditioners, adequate security
- ii. **Chemical Conversation:** use insecticide to reinstate brittle and damaged book, fumigation to destroy eggs and larvae of insects and termites, encapsulation

- iii. **Photocopying / Reprographic:** through photocopying and microfilms are taken
- iv. **Digital conservation:** scanned and copied in CD and DVD, replicating of old CD / hard disk or server backup

#### IV. MAIN CAUSES OF DETERIORATION OF LIBRARY MATERIAL: PRINTED MATERIAL

There are various causes of deterioration of print material. Some of them are : High acidity levels, wear and tear due to more usage and photocopying and rough handling, air pollution, high temperature in the library, relative humidity, high light, dust, termite, spiders, cockroaches, congested or bad shelving etc.

#### **Non-printed material**

The causes for deterioration of non print material is due to rough handling which causes scratched in CD or DVD, dust, wavy pack, air-conditioning temperature, humidity

#### V. MAIN HINDRANCE TO EFFECTIVE PRESERVATION OR CONSERVATION OF LIBRARY MATERIAL

- 1. Lack of Digital qualified staff and trained personnel
- 2. Lack of complete infrastructure
- 3. Lack of training to the existing staff
- 4. Severe environment conditions
- 5. Hardware or software not available
- 6. Lack of library committee or management initiative
- 7. Lack of written policy on preservation or conservation
- 8. Lack of finance

#### VI. RECOMMENDATION AND SUGGESTIONS

- 1. The library should list down the preservation and conservation techniques for print and digital material.
- 2. The library should find out the reasons for proper conservation or preservation policy and find out its solution.
- 3. In case of any natural calamities like fire, flood, etc. there should be written plan.
- 4. In every library there should be fire detection and suppression system installed.
- 5. In the library budget there is proper provision of allocation of amount for preservation / conservation of library heritage
- 6. The library should find out the cause of deteriorating of print or digital material.
- 7. Workshops should be conducted and different training courses should be started for preserve and conserve library material in different ways
- 8. Training should be given to operate different equipments such as microfilm cameras, fire extinguishers, scanners,

photocopying, copying in CD and DVD, server backup, etc.

- 9. The librarian should give awareness to the management / higher authority/ library committee about the preservation and conservation of library material
- 10. **“Prevention is Better than Cure”** this philosophy should be adopted by libraries of all institutions.
- 11. Librarian should learn to adapt themselves with the changing technology and changing scenario.

#### VII. CONCLUSION

After reading the literature survey, it is observed that Indian institutions have adopted preservation and conservation techniques for printed material but digital material is overlooked. Almost all the institutions have adopted mending, repairing and binding, cleaning, dusting, shelving, lamination, installing air-conditioners, adequate security, fire extinguishers, use of insecticide, fumigation, photocopying for library material so that its life can be increased. Still these libraries lack scanning, microfilming, and conversion of DVD and CD and replicating digital material such as CD and DVD, timely server backup due to finance, manpower, and crunch of digital and other resources.

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# Coupled fixed point theorems for generalized $(\alpha, \psi)$ -contractive type maps

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**Abstract:** In this paper, we introduce generalized  $(\alpha, \psi)$ -contractive maps and prove the existence and uniqueness of coupled fixed points for generalized  $(\alpha, \psi)$ -contractive maps in  $G$ -metric spaces. Furthermore, we provide examples in support of our results.

**Keywords:**  $\alpha$ -admissible,  $(\alpha, \psi)$ -contractive maps, mixed monotone property, coupled fixed point, generalized  $(\alpha, \psi)$ -contractive map.

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## 1 Introduction

Fixed points and fixed point theorems have always a prominent role to find the existence of solutions of problems that arise in theoretical mathematics. In 1922, Banach [2] proved a remarkable results in this direction that each contraction in a complete metric space has a unique fixed point. Later many authors have directed their attention to this concept and have generalized the Banach fixed point theorems in various ways. In 2012, Samet, Vetro and Vetro [7] introduced a new concept namely ' $(\alpha, \psi)$ -contractive' mappings and proved the related fixed points of such mappings in metric space setting.

Recently, Mustafa and Sims [4] introduction a new concept namely generalized metric space called  $G$ -metric space and characterized Banach fixed point theorem in the context of  $G$ -metric space. For more works on the existence of fixed points and coupled fixed points in  $G$ -metric spaces, we refer [4].

In 1987, Guo and Lakshmi Kantham [12] introduced the notion of a coupled fixed points for mixed monotone operators. The concept of a coupled fixed point was reconsidered by Gnana-Bhaskar and Lakshmi Kantham [11] in 2006. They proved

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and discussed the existence and uniqueness of a coupled fixed point of an operator  $F : X \times X \rightarrow X$  on a partially ordered metric spaces, we refer [11].

Later, Alghamdi and Karapinar [5] introduced the new concept namely  $(G, \beta, \psi)$ -contractive type maps which are generalizations of  $(\alpha, \psi)$ -contractive maps, proved existence and uniqueness of fixed points of such contractive maps in  $G$ -metric spaces.

## 2 Preliminaries

Throughout this paper we denote by  $\Psi$  the family of nondecreasing functions  $\psi : [0, \infty) \rightarrow [0, \infty)$  which satisfies  $\sum_{n=1}^{\infty} \psi^n(t) < \infty$  for each  $t > 0$  where  $\psi^n$  is the  $n^{th}$  iterate of  $\psi$ .

*Remark 2.1.* Any function  $\psi \in \Psi$  satisfies  $\lim_{n \rightarrow \infty} \psi^n(t) = 0$ ,  $\psi(t) < t$  for any  $t > 0$  and  $\psi$  is continuous at 0.

**Definition 2.2.** (Samet, Vetro and Vetro [7, Definition 2.1]) Let  $(X, d)$  be a metric space and  $T : X \rightarrow X$ . We say that  $T$  is  $(\alpha, \psi)$ -contractive mapping if there exist two functions  $\alpha : X \times X \rightarrow [0, \infty)$  and  $\psi \in \Psi$  such that  $\alpha(x, y)d(Tx, Ty) \leq \psi(d(x, y))$  for all  $x, y \in X$ . (2.2.1)

**Definition 2.3.** (Samet, Vetro and Vetro [7, Definition 2.1]) Let  $(X, d)$  be a metric space,  $T : X \rightarrow X$  and  $\alpha : X \times X \rightarrow [0, \infty)$ . We say that  $T$  is  $\alpha$ -admissible if  $x, y \in X$   $\alpha(x, y) \geq 1 \Rightarrow \alpha(Tx, Ty) \geq 1$ . (2.3.1)

For examples on  $\alpha$ -admissible functions, we refer [7] and for more works on  $\alpha$ -admissible functions, we refer [[8], [10], [9], [6]].

**Theorem 2.4.** (Samet, Vetro and Vetro [7, Theorem 2.1]) *Let  $(X, d)$  be a complete metric space and  $T : X \rightarrow X$ . Suppose that there exist two functions  $\alpha : X \times X \rightarrow [0, \infty)$  and  $\psi \in \Psi$  such that  $T$  is  $(\alpha, \psi)$ -contractive map.*

*Also, assume that*

- (i)  $T$  is  $\alpha$ -admissible;
- (ii) there exists  $x_0 \in X$  such that  $\alpha(x_0, Tx_0) \geq 1$ ; either
- (iii)  $T$  is continuous; (or)
- (iv) if  $\{x_n\}$  is a sequence in  $X$  such that  $\alpha(x_n, x_{n+1}) \geq 1$  for all  $n$  and  $x_n \rightarrow x$  as  $n \rightarrow \infty$ , then  $\alpha(x_n, x) \geq 1$  for all  $n$ .

*Then  $T$  has a fixed point. i.e., there exists  $u \in X$  such that  $Tu = u$ .*

**Definition 2.5.** (Karapinar and Samet [8, Definition 2.1]) Let  $(X, d)$  be a metric space and  $T : X \rightarrow X$  be a given mapping. We say that  $T$  is a generalized  $(\alpha, \psi)$ -contractive mapping if there exist two functions  $\alpha : X \times X \rightarrow [0, \infty)$  and  $\psi \in \Psi$  such that for all  $x, y \in X$

$$\alpha(x, y)d(Tx, Ty) \leq \psi(M(x, y)), \text{ where} \tag{2.5.1}$$

$$M(x, y) = \max\left\{d(x, y), \frac{d(x, Tx) + d(y, Ty)}{2}, \frac{d(x, Ty) + d(y, Tx)}{2}\right\}.$$

**Theorem 2.6.** (Karapinar and Samet [8, Theorem 2.3]) *Let  $(X, d)$  be a complete metric space and  $T : X \rightarrow X$ . Suppose that there exist two functions  $\alpha : X \times X \rightarrow [0, \infty)$  and  $\psi \in \Psi$  such that  $T$  is a generalized  $(\alpha, \psi)$ -contractive map. Also, assume that the following conditions are satisfied:*

- (i)  $T$  is  $\alpha$ -admissible;
- (ii) there exists  $x_0 \in X$  such that  $\alpha(x_0, Tx_0) \geq 1$ ; either
- (iii)  $T$  is continuous; (or)
- (iv) if  $\{x_n\}$  is a sequence in  $X$  such that  $\alpha(x_n, x_{n+1}) \geq 1$  for all  $n$  and  $x_n \rightarrow x$  as  $n \rightarrow \infty$ , then there exists a subsequence  $\{x_{n_k}\}$  of  $\{x_n\}$  such that  $\alpha(x_{n_k}, x) \geq 1$  for all  $k$ .

Then there exists  $u \in X$  such that  $Tu = u$ .

Mustafa and Sims [4] introduced the concept of  $G$ -metric space and proved fixed point results in complete  $G$ -metric spaces. After that, Alghamdi and Karapinar [5] proved some fixed point results in complete  $G$ -metric spaces.

**Definition 2.7.** [11] Let  $(X, \preceq)$  be a partially ordered set and  $F : X \times X \rightarrow X$  the mapping  $F$  is said to have the *mixed monotone property* if  $F(x, y)$  is monotone non-decreasing in  $x$  and monotone non-increasing in  $y$ , that is for any  $x, y \in X$ ,  $x_1, x_2 \in X$ ,  $x_1 \preceq x_2 \Rightarrow F(x_1, y) \preceq F(x_2, y)$   
 $y_1, y_2 \in X$ ,  $y_1 \preceq y_2 \Rightarrow F(x, y_1) \succeq F(x, y_2)$ .

**Definition 2.8.** [11] An element  $(x, y) \in X \times X$  is called a *coupled fixed point* of the mapping  $F : X \times X \rightarrow X$  if  $F(x, y) = x$ ,  $F(y, x) = y$ .

**Definition 2.9.** [11] Let  $X$  be a non-empty set and  $F : X \times X \rightarrow X$  be a mapping. An element  $x \in X$  is called a *fixed point* of  $F$  if  $x = F(x, x)$ .

**Theorem 2.10.** [11] *Let  $(X, \preceq)$  be a partially ordered set and suppose that there is a metric  $d$  on  $X$  such that  $(X, d)$  is a complete metric space. Let  $F : X \times X \rightarrow X$  be a mapping having mixed monotone property on  $X$ . Assume that there exists  $k \in [0, 1)$  such that*

$$d(F(x, y), F(u, v)) \leq \frac{k}{2}[d(x, u) + d(y, v)]$$

for all  $x, y, u, v \in X$  with  $x \succeq u$  and  $y \preceq v$ . Suppose that either

- (i)  $F$  is continuous (or);
- (ii)  $X$  has the following property
  - (a) if  $\{x_n\}$  is a non-decreasing sequence with  $\{x_n\} \rightarrow x$  then  $\{x_n\} \leq x$  for all  $n$ .
  - (b) if  $\{x_n\}$  is a non-decreasing sequence with  $\{x_n\} \rightarrow x$  then  $\{x_n\} \leq x$  for all  $n$ .

Further, if there exist  $x_0, y_0 \in X$  such that  $x_0 \preceq F(x_0, y_0)$  and  $y_0 \succeq F(y_0, x_0)$ , then there exist  $x, y \in X$  such that  $x = F(x, y)$  and  $y = F(y, x)$ . i.e.,  $F$  has a coupled fixed point in  $X$ .

**Lemma 2.11.** [6] Let  $F : X \times X \rightarrow X$  be a given mapping. Define the mapping  $T_F : X \times X \rightarrow X \times X$  by  $T_F(x, y) = (F(x, y), F(y, x))$  for all  $(x, y) \in X \times X$ . Then  $(x, y)$  is fixed point of  $T_F$  if and only if  $(x, y)$  is a coupled fixed point of  $F$ .

**Lemma 2.12.** [6] Let  $(X, G)$  be a  $G$ -metric space. A mapping  $F : X \times X \rightarrow X$  is said to be continuous if for any two  $G$ -Convergent sequence  $\{x_n\}$  and  $\{y_n\}$  converging to  $x$  and  $y$ , respectively,  $\{F(x_n, y_n)\}$  is  $G$ -converging to  $F(x, y)$ .

Alghamdi and Karapinar [5] proved the following results.

**Theorem 2.13.** Let  $(X, G)$  be a complete  $G$ -metric space and let  $F : X \times X \rightarrow X$  be a given mapping. Suppose there exist  $\psi \in \Psi$  and the function  $\beta : X^2 \times X^2 \times X^2 \rightarrow [0, \infty)$  such that

$$\beta((x, y), (u, v), (u, v))G(F(x, y), F(u, v), F(u, v)) \leq \frac{1}{2}(\psi(G(x, u, u) + G(y, v, v))) \quad (2.13.1)$$

for all  $(x, y), (u, v) \in X \times X$ . Suppose that

- (i) for all  $(x, y), (u, v) \in X \times X$ , we have  
 $\beta((x, y), (u, v), (u, v)) \geq 1$  implies  
 $\beta((F(x, y), F(y, x)), (F(u, v), F(v, u)), (F(u, v), F(v, u))) \geq 1$
- (ii) there exist  $(x_0, y_0, y_0) \in X \times X \times X$  such that  
 $\beta((x_0, y_0), (F(x_0, y_0), (F(y_0, x_0))), (F(x_0, y_0), (F(y_0, x_0)))) \geq 1$  and  
 $\beta((F(y_0, x_0), (F(x_0, y_0))), (F(y_0, x_0), (F(x_0, y_0)(y_0, x_0)))) \geq 1$
- (iii) either  $F$  is continuous; (or)
- (iv) if  $\{x_n\}$  and  $\{y_n\}$  are sequences in  $X$  such that  
 $\beta((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1}))$

then  $F$  has a coupled fixed point. i.e., there exist  $(x^*, y^*) \in X \times X$  such that  $F(x^*, y^*) = x^*$  and  $F(y^*, x^*) = y^*$ .

**Definition 2.14.** [12] Let  $X$  be a nonempty set  $F : X \times X \rightarrow X$  and  $g : X \rightarrow X$  then

- (i) An element  $(x, y) \in X \times X$  is called a *coupled coincidence point* of the mappings  $F$  and  $g$  if  $F(x, y) = g(x)$ ,  $F(y, x) = g(y)$ .
- (ii) An element  $(x, y) \in X \times X$  is called a *common coupled coincidence point* of the mappings  $F$  and  $g$  if  $F(x, y) = g(x) = x$ ,  $F(y, x) = g(y) = y$ .

### 3 Main Result

We introduce the concept of  $F$  is generalized  $(\alpha, \psi)$ -contractive type mappings as follows:

**Definition 3.1.** Let  $(X, G)$  be a  $G$ -metric space. Let  $F : X \times X \rightarrow X$  be a map if there exist two function  $\alpha : X^2 \times X^2 \times X^2 \rightarrow [0, \infty)$  and  $\psi \in \Psi$  such that

$$\alpha((x, y), (u, v), (u, v))G(F(x, y), F(u, v), F(u, v)) \leq \frac{1}{2}\psi(\max\{G(x, u, u) + G(y, v, v), \frac{1}{2}(G(x, F(x, y), F(x, y)) + G(y, F(y, x), F(y, x))) + (G(u, F(u, v), F(u, v)) + G(v, F(v, u), F(v, u))), \frac{1}{2}(G(x, F(u, v), F(u, v)) + G(y, F(v, u), F(v, u))) + (G(u, F(x, y), F(x, y)) + G(v, F(y, x), F(y, x)))\}) \tag{3.1.1}$$

for all  $(x, y), (u, v) \in X \times X$ ,

then we say that  $F$  is *generalized  $(\alpha, \psi)$ -contractive map* in two variables.

**Example 3.2.** Let  $X = \{0, 1, 3\}$ . We define  $G : X^3 \rightarrow \mathbb{R}_+$  by  $G(x, y, z) = d(x, y) + d(y, z) + d(z, x)$ . Let  $A = \{(3, 0), (0, 3)\}$ ,  $B = \{(0, 0), (1, 1), (3, 3), (3, 1), (1, 3)\}$  and  $C = \{(1, 0), (0, 1)\}$ . We define mapping  $F : X \rightarrow X$  by  $F(x, y) = \begin{cases} 1 & \text{if } (x, y) \in A \\ 0 & \text{if } (x, y) \in B \\ 3 & \text{if } (x, y) \in C. \end{cases}$

We define  $\alpha : X^3 \rightarrow [0, +\infty)$  and  $\psi : \mathbb{R}^+ \rightarrow \mathbb{R}^+$  by

$$\alpha((x, y), (u, v), (u, v)) = \begin{cases} \frac{6}{5} & \text{if } (x, y) \in A, (u, v) \in B \\ 0 & \text{otherwise} \end{cases} \quad \text{and} \quad \psi(t) = \frac{11t}{12} \text{ for all } t > 0.$$

Now, we verify the inequality (3.1.1) as follows:

Case (i):  $(x, y) = (3, 0)$  and  $(u, v) = (0, 0)$

In this case,  $F(3, 0) = F(0, 3) = 1$ ,  $F(0, 0) = 0$ ,  $\alpha((3, 0), (0, 0), (0, 0)) = \frac{6}{5}$  and  $M((3, 0), (0, 0)) = 6$

$$\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((3, 0), (0, 0), (0, 0))G((3, 0), (0, 0), (0, 0)) = \frac{12}{5} \leq \frac{1}{2}(\psi(M((3, 0), (0, 0)))) = \frac{1}{2}(\psi(M((x, y), (u, v)))).$$

Case (ii):  $(x, y) = (3, 0)$  and  $(u, v) = (1, 1)$

In this case,  $F(3, 0) = F(0, 3) = 1$ ,  $F(1, 1) = 0$ ,  $\alpha((3, 0), (1, 1), (1, 1)) = \frac{6}{5}$  and  $M((3, 0), (1, 1)) = 6$

$$\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((3, 0), (1, 1), (1, 1))G((3, 0), (1, 1), (1, 1)) = \frac{12}{5} \leq \frac{1}{2}(\psi(M((3, 0), (1, 1)))) = \frac{1}{2}(\psi(M((x, y), (u, v)))).$$

Case (iii):  $(x, y) = (3, 0)$  and  $(u, v) = (3, 3)$

In this case,  $F(3, 0) = F(0, 3) = 1$ ,  $F(3, 3) = 0$ ,  $\alpha((3, 0), (3, 3), (3, 3)) = \frac{6}{5}$  and  $M((3, 0), (3, 3)) = 10$

$$\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((3, 0), (3, 3), (3, 3))G((3, 0), (3, 3), (3, 3)) = \frac{12}{5} \leq \frac{1}{2}(\psi(M((3, 0), (3, 3)))) = \frac{1}{2}(\psi(M((x, y), (u, v)))).$$

Case (iv):  $(x, y) = (3, 0)$  and  $(u, v) = (3, 1)$

In this case,  $F(3, 0) = F(0, 3) = 1$ ,  $F(3, 1) = F(1, 3) = 0$ ,  $\alpha((3, 0), (3, 1), (3, 1)) = \frac{6}{5}$  and  $M((3, 0), (3, 1)) = 6$

$$\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((3, 0), (3, 1), (3, 1))G((3, 0), (3, 1), (3, 1)) = \frac{12}{5} \leq \frac{1}{2}(\psi(M((3, 0), (3, 1)))) = \frac{1}{2}(\psi(M((x, y), (u, v)))).$$

Case (v):  $(x, y) = (3, 0)$  and  $(u, v) = (1, 3)$

In this case,  $F(3, 0) = F(0, 3) = 1$ ,  $F(3, 1) = F(1, 3) = 0$ ,  $\alpha((3, 0), (1, 3), (1, 3)) = \frac{6}{5}$

and  $M((3, 0), (1, 3)) = 10$   
 $\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((3, 0), (1, 3), (1, 3))G((3, 0), (1, 3), (1, 3))$   
 $= \frac{12}{5} \leq \frac{1}{2}(\psi(M((3, 0), (1, 3)))) = \frac{1}{2}(\psi(M((x, y), (u, v))))).$

Case (vi):  $(x, y) = (0, 3)$  and  $(u, v) = (0, 0)$

In this case,  $F(0, 3) = F(3, 0) = 1$ ,  $F(0, 0) = 0$ ,  $\alpha((0, 3), (0, 0), (0, 0)) = \frac{6}{5}$  and  $M((0, 3), (0, 0)) = 6$

$\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((0, 3), (0, 0), (0, 0))G((0, 3), (0, 0), (0, 0))$   
 $= \frac{12}{5} \leq \frac{1}{2}(\psi(M((3, 0), (0, 0)))) = \frac{1}{2}(\psi(M((x, y), (u, v))))).$

Case (vii):  $(x, y) = (0, 3)$  and  $(u, v) = (1, 1)$

In this case,  $F(0, 3) = F(3, 0) = 1$ ,  $F(1, 1) = 0$ ,  $\alpha((0, 3), (1, 1), (1, 1)) = \frac{6}{5}$  and  $M((0, 3), (1, 1)) = 6$

$\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((0, 3), (1, 1), (1, 1))G((0, 3), (1, 1), (1, 1))$   
 $= \frac{12}{5} \leq \frac{1}{2}(\psi(M((0, 3), (1, 1)))) = \frac{1}{2}(\psi(M((x, y), (u, v))))).$

Case (viii):  $(x, y) = (0, 3)$  and  $(u, v) = (3, 3)$

In this case,  $F(0, 3) = F(3, 0) = 1$ ,  $F(3, 3) = 0$ ,  $\alpha((0, 3), (3, 3), (3, 3)) = \frac{6}{5}$  and  $M((0, 3), (3, 3)) = 9$

$\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((0, 3), (3, 3), (3, 3))G((0, 3), (3, 3), (3, 3))$   
 $= \frac{12}{5} \leq \frac{1}{2}(\psi(M((0, 3), (3, 3)))) = \frac{1}{2}(\psi(M((x, y), (u, v))))).$

Case (ix):  $(x, y) = (0, 3)$  and  $(u, v) = (3, 1)$

In this case,  $F(3, 0) = F(0, 3) = 1$ ,  $F(3, 1) = F(1, 3) = 0$ ,  $\alpha((0, 3), (3, 1), (3, 1)) = \frac{6}{5}$  and  $M((0, 3), (3, 1)) = 10$

$\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((0, 3), (3, 1), (3, 1))G((0, 3), (3, 1), (3, 1))$   
 $= \frac{12}{5} \leq \frac{1}{2}(\psi(M((0, 3), (3, 1)))) = \frac{1}{2}(\psi(M((x, y), (u, v))))).$

Case (x):  $(x, y) = (0, 3)$  and  $(u, v) = (1, 3)$

In this case,  $F(3, 0) = F(0, 3) = 1$ ,  $F(3, 1) = F(1, 3) = 0$ ,  $\alpha((0, 3), (1, 3), (1, 3)) = \frac{6}{5}$  and  $M((0, 3), (1, 3)) = 10$

$\alpha((x, y), (u, v), (u, v))G((x, y), (u, v), (u, v)) = \alpha((0, 3), (1, 3), (1, 3))G((0, 3), (1, 3), (1, 3))$   
 $= \frac{12}{5} \leq \frac{1}{2}(\psi(M((0, 3), (1, 3)))) = \frac{1}{2}(\psi(M((x, y), (u, v))))).$

Therefore, the inequality (3.1.1) satisfies. Hence  $F$  is *generalized  $(\alpha, \psi)$ -contractive map* in two variables.

Here, we observe that the inequality (2.13.1) fails to hold.

For, by choosing  $(x, y) = (3, 0)$  and  $(u, v) = (3, 1)$  we have

$\alpha((3, 0), (3, 1), (3, 1))G((3, 0), (3, 1), (3, 1)) = \frac{12}{5} \not\leq \frac{1}{2}(\psi(G(3, 3, 3) + G(0, 1, 1)))$

so it is a generalization.

**Theorem 3.3.** *Let  $(X, G)$  be a complete  $G$ -metric space. Let  $F : X \times X \rightarrow X$  be generalized  $(\alpha, \psi)$ -contractive map in two variables satisfying the following conditions.*

(i) *for all  $(x, y), (u, v) \in X \times X$ , we have*

$\alpha((x, y), (u, v), (u, v)) \geq 1$  *implies*

$\alpha((F(x, y), F(y, x)), (F(u, v), F(v, u)), (F(u, v), F(v, u))) \geq 1$

(ii) *there exist  $(x_0, y_0, y_0) \in X \times X \times X$  such that*

$\alpha((x_0, y_0), (F(x_0, y_0), (F(y_0, x_0))), (F(x_0, y_0), (F(y_0, x_0)))) \geq 1$  *and*

$\alpha((F(y_0, x_0), (F(x_0, y_0))), (F(y_0, x_0), (F(x_0, y_0)))) \geq 1$

(iii)  $F$  is continuous.

then  $F$  has a coupled fixed point. i.e., there exist  $(x^*, y^*) \in X \times X$  such that  $F(x^*, y^*) = x^*$  and  $F(y^*, x^*) = y^*$ .

*Proof.* Let  $(Y, \delta)$  be a complete  $G$ -metric space with  $Y = X \times X$  and  $\delta((x, y), (u, v), (s, t)) = G(x, u, s) + G(y, v, t)$  for all  $(x, y), (u, v), (s, t) \in Y$ .

By using (3.3.1) and (G4) we get

$$\begin{aligned} \alpha((x, y), (u, v), (u, v))G(F(x, y), F(u, v), F(u, v)) &\leq \frac{1}{2}\psi(\max\{G(x, u, u) + G(y, v, v), \\ \frac{1}{2}(G(x, F(x, y), F(x, y)) + G(y, F(y, x), F(y, x))) + (G(u, F(u, v), F(u, v)) \\ + G(v, F(v, u), F(v, u))), \frac{1}{2}(G(x, F(u, v), F(u, v)) + G(y, F(v, u), F(v, u))) \\ + (G(u, F(x, y), F(x, y)) + G(v, F(y, x), F(y, x)))\}) \\ \alpha((x, y), (u, v), (u, v))G(F(x, y), F(u, v), F(u, v)) &\leq \frac{1}{2}\psi(\max\{\delta((x, y), (u, v), (u, v)), \\ \frac{1}{2}(\delta((x, y), F(x, y), F(y, x)) + \delta((u, v), F(u, v), F(v, u))), \\ \frac{1}{2}(\delta((x, y), F(u, v), F(v, u)) + \delta((u, v), F(x, y), F(y, x)))\}) \end{aligned} \tag{3.3.1}$$

Similarly

$$\begin{aligned} \alpha((v, u), (v, u), (y, x))G(F(v, u), F(v, u), F(y, x)) &\leq \frac{1}{2}\psi(\max\{G(v, v, y) + G(u, u, x), \\ \frac{1}{2}(G(F(y, x), F(y, x), y) + G(F(x, y), F(x, y), x)) + (G(F(v, u), F(v, u), v) \\ + G(F(u, v), F(u, v), u)), \frac{1}{2}(G(F(y, x), F(y, x), v) + G(F(x, y), F(x, y), u)) + \\ (G(F(v, u), F(v, u), y) + G(F(u, v), F(u, v), x)))\}) \\ \alpha((v, u), (v, u), (y, x))G(F(v, u), F(v, u), F(y, x)) &\leq \frac{1}{2}\psi(\max\{\delta((v, u), (v, u), (y, x)), \\ \frac{1}{2}(\delta((y, x), F(y, x), F(x, y)) + \delta((v, u), F(v, u), F(u, v))), \\ \frac{1}{2}(\delta((y, x), F(v, u), F(u, v)) + \delta((v, u), F(y, x), F(x, y)))\}) \end{aligned} \tag{3.3.2}$$

Adding the inequalities (3.3.1) and (3.3.2) we get

$$\begin{aligned} \alpha((x, y), (u, v), (u, v))G(F(x, y), F(u, v), F(u, v)) + \\ \alpha((v, u), (v, u), (y, x))G(F(v, u), F(v, u), F(y, x)) &\leq \psi(\max\{\delta((x, y), (u, v), (u, v)), \\ \frac{1}{2}[\delta((x, y), (F(x, y), F(y, x)), (F(x, y), F(y, x))) + \delta((u, v), (F(u, v), F(v, u)), (F(u, v), F(v, u))), \\ \frac{1}{2}[\delta((x, y), (F(u, v), F(v, u)), (F(u, v), F(v, u))) \\ + \delta((u, v), (F(x, y), F(y, x)), (F(x, y), F(y, x)))]\}) \end{aligned} \tag{3.3.3}$$

Choose  $\beta : Y \times Y \times Y \rightarrow [0, \infty)$  is given by

$$\beta((x, y), (u, v), (u, v)) = \min\{\alpha((x, y), (u, v), (u, v)), \alpha((v, u), (v, u), (y, x))\}$$

Defined  $T : Y \rightarrow Y$  by  $T(x, y) = (F(x, y), F(y, x))$  Since  $T$  is continuous and  $G - \beta - \psi$  contractive mapping of equation (3.3.1)

$$\begin{aligned} \beta((x, y), (u, v), (u, v))\delta((F(x, y), (y, x)), (F(u, v), F(v, u)), (F(u, v), F(v, u))) \\ \leq \psi(\max\{\delta((x, y), (u, v), (u, v)), \frac{1}{2}[\delta((x, y), (F(x, y), F(y, x)), (F(x, y), F(y, x))) \\ + \delta((u, v), (F(u, v), F(v, u)), (F(u, v), F(v, u))], \frac{1}{2}[\delta((x, y), (F(u, v), F(v, u)), (F(u, v), F(v, u))) \\ + \delta((u, v), (F(x, y), F(y, x)), (F(x, y), F(y, x)))]\}) \end{aligned}$$

That is

$$\begin{aligned} \beta((x, y), (u, v), (u, v))\delta(T(x, y), T(u, v), T(u, v)) &\leq (\max\{\delta((x, y), (u, v), (u, v)), \\ \frac{1}{2}[\delta((x, y), (F(x, y), F(y, x)), (F(x, y), F(y, x))) + \delta((u, v), (F(u, v), F(v, u)), (F(u, v), F(v, u))], \\ \frac{1}{2}[\delta((x, y), (F(u, v), F(v, u)), (F(u, v), F(v, u))) + \delta((u, v), (F(x, y), F(y, x)), (F(x, y), F(y, x)))]\}) \end{aligned}$$

Therefore  $T$  is a generalized  $(\beta, \psi)$  contractive map.

We now show that  $T$  is  $\beta$ -admissible.

Let  $(x, y), (u, v) \in Y$  be such that

$$\begin{aligned} \beta((x, y), (u, v), (u, v)) = \min\{\alpha((x, y), (u, v), (u, v)), \alpha((v, u), (v, u), (y, x))\} \\ \geq 1 \end{aligned} \tag{3.3.4}$$

Since  $\alpha((x, y), (u, v), (u, v)) \geq 1$  and  $\alpha((v, u), (v, u), (y, x)) \geq 1$

Hence by (i),

$$\begin{aligned} \beta(T(x, y), T(u, v), T(u, v)) &= \beta((F(x, y), (y, x)), (F(u, v), F(v, u)), (F(u, v), F(v, u))) \\ &= \min\{\alpha((F(x, y), (y, x)), (F(u, v), (v, u))), (F(u, v), F(v, u)), \\ &\quad \alpha((F(v, u), (u, v)), (F(v, u), (u, v)), (F(y, x), F(x, y)))\} \geq 1 \end{aligned}$$

By using (3.3.4) and (i). Hence  $T$  is  $\beta$ -admissible.

Now by (ii), there exists  $(x, y) \in X \times X$  such that

$$\begin{aligned} \beta((x_0, y_0), (T(x_0, y_0), T(x_0, y_0))) &= \beta((x_0, y_0), (F(x_0, y_0), F(y_0, x_0))) \\ &= \min\{\alpha((x_0, y_0), (F(x_0, y_0), F(y_0, x_0))), (F(x_0, y_0), F(y_0, x_0)), \\ &\quad \alpha((x_0, y_0), (F(x_0, y_0), F(y_0, x_0)), (F(x_0, y_0), F(y_0, x_0)))\} \geq 1 \text{ by (ii)} \end{aligned}$$

We show that  $T$  is continuous.

Let  $(a, b) \in X \times X$ . We have  $T(x, y) = (F(x, y), F(y, x))$  for all  $x, y \in X$ .

$$\begin{aligned} \text{Therefore } \lim_{(x,y) \rightarrow (a,b)} T(x, y) &= \lim_{(x,y) \rightarrow (a,b)} (F(x, y), F(y, x)) \\ &= (\lim_{(x,y) \rightarrow (a,b)} (F(x, y)), \lim_{(x,y) \rightarrow (a,b)} (F(y, x))) \\ &= (F(a, b), F(b, a)) = T(a, b) \end{aligned}$$

and hence  $T$  is continuous. Hence  $T$  has a fixed point  $(x^*, y^*)$  in  $Y$ . Therefore by Lemma 2.11 and  $(x^*, y^*)$  is a coupled fixed point of  $F$ .  $\square$

**Theorem 3.4.** Let  $(X, G)$  be a complete  $G$ -metric space. Let  $F : X \times X \rightarrow X$  be generalized  $(\alpha, \psi)$  contractive map in two variables satisfying the following conditions.

(i) for all  $(x, y), (u, v) \in X \times X$ , we have

$$\begin{aligned} \alpha((x, y), (u, v), (u, v)) &\geq 1 \text{ implies} \\ \alpha((F(x, y), F(y, x)), (F(u, v), F(v, u)), (F(u, v), F(v, u))) &\geq 1 \end{aligned}$$

(ii) there exist  $(x_0, y_0, y_0) \in X \times X \times X$  such that

$$\begin{aligned} \alpha((x_0, y_0), (F(x_0, y_0), (F(y_0, x_0))), (F(x_0, y_0), (F(y_0, x_0)))) &\geq 1 \text{ and} \\ \alpha((F(y_0, x_0), (F(x_0, y_0))), (F(y_0, x_0), (F(x_0, y_0)(y_0, x_0)))) &\geq 1 \end{aligned}$$

(iii) if  $\{x_n\}$  and  $\{y_n\}$  are sequence of  $X$  such that

$$\begin{aligned} \alpha((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1})) &\geq 1 \\ \text{and } \alpha((y_{n+1}, x_{n+1}), (y_{n+1}, x_{n+1}), (y_n, x_n)) &\geq 1 \\ \{x_n\} \text{ and } \{y_n\} \text{ are convergent to } x \text{ and } y \text{ respectively. then} \\ \alpha((x_n, y_n), (x, y), (x, y)) &\geq 1 \text{ and } \alpha((y, x), (y, x), (y_n, x_n)) \geq 1 \\ \text{then } F \text{ has a coupled fixed point. i.e there exist } (x^*, y^*) \in X \times X \text{ such that} \\ F(x^*, y^*) &= x^* \text{ and } F(y^*, x^*) = y^*. \end{aligned}$$

*Proof.* In above Theorem 3.3 we prove (i) and (ii) conditions

Now to prove condition (iii) by using equation (ii)

let  $(x_0, y_0, y_0) \in X \times X \times X$  such that

$$\alpha((x_0, y_0), (F(x_0, y_0), (F(y_0, x_0))), (F(x_0, y_0), (F(y_0, x_0)))) \geq 1 \tag{3.4.1}$$

$$\text{and } \alpha((F(y_0, x_0), (F(x_0, y_0))), (F(y_0, x_0), (F(x_0, y_0)(y_0, x_0)))) \geq 1. \tag{3.4.2}$$

We define the sequence  $(\{x_n\}, \{y_n\}) \in X \times X$  by

$$x_{n+1} = F(x_n, y_n) \text{ and } y_{n+1} = F(y_n, x_n)$$

Now  $x_n = x_{n+1}$  and  $y_n = y_{n+1}$  for some  $n$  then  $(x_n, y_n)$  is a coupled fixed point of  $X$ .

Now  $x_n \neq x_{n+1}$  and  $y_n \neq y_{n+1}$  then by equation (3.4.1) we have

$$\begin{aligned} &\alpha((x_0, y_0), (x_1, y_1), (x_1, y_1)) \geq 1 \text{ and} \\ &\alpha((F(x_0, y_0), F(y_0, x_0)), (F(x_1, y_1), F(y_1, x_1)), (F(x_1, y_1), F(y_1, x_1))) \geq 1 \\ &\text{i.e., } \alpha((x_1, y_1), (x_2, y_2), (x_2, y_2)) \geq 1 \text{ continuing this process, we get} \\ &\alpha((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1})) \geq 1 \\ &\text{Now } G(F(x_{n-1}, y_{n-1}), F(x_n, y_n), F(x_n, y_n)) \leq \\ &\alpha((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n))G(F(x_{n-1}, y_{n-1}), F(x_n, y_n), F(x_n, y_n)) \\ &\leq \frac{\psi}{2}(\max\{G(x_{n-1}, x_n, x_n) + G(y_{n-1}, y_n, y_n), \\ &\frac{1}{2}[G(x_{n-1}, F(x_{n-1}, y_{n-1}), F(x_{n-1}, y_{n-1})) + G(y_{n-1}, F(y_{n-1}, x_{n-1}), F(y_{n-1}, x_{n-1})) \\ &+ G(x_n, F(x_n, y_n), F(x_n, y_n)) + G(y_n, F(y_n, x_n), F(y_n, x_n))], \\ &\frac{1}{2}[G(x_{n-1}, F(x_n, y_n), F(x_n, y_n)) + G(y_{n-1}, F(y_n, x_n), F(y_n, x_n)) \\ &+ G(x_n, F(x_{n-1}, y_{n-1}), F(x_{n-1}, y_{n-1})) + G(y_n, F(y_{n-1}, x_{n-1}), F(y_{n-1}, x_{n-1}))]\}) \\ &\leq \frac{\psi}{2}(\max\{G(x_{n-1}, x_n, x_n) + G(y_{n-1}, y_n, y_n), \\ &\frac{1}{2}[G(x_{n-1}, x_n, x_n) + G(y_{n-1}, y_n, y_n) + G(x_n, x_{n+1}, x_{n+1}) + G(y_n, y_{n+1}, y_{n+1})], \\ &\frac{1}{2}[G(x_{n-1}, x_{n+1}, x_{n+1}) + G(y_{n-1}, y_{n+1}, y_{n+1}) + G(x_n, x_n, x_n) + G(y_n, y_n, y_n)]\}) \\ &\leq \frac{\psi}{2}(\max\{\delta((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n)), \\ &\frac{1}{2}[\delta((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n)) + \delta((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1}))], \\ &\frac{1}{2}[\delta((x_{n-1}, y_{n-1}), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1})) + 0]\}) \end{aligned} \tag{3.4.3}$$

$$\begin{aligned} &\text{Similarly, } G(F(y_n, x_n), F(y_n, x_n), F(y_{n-1}, x_{n-1})) \leq \frac{\psi}{2}(\max\{\delta((y_n, x_n), (y_n, x_n), (y_{n-1}, x_{n-1})), \\ &\frac{1}{2}[\delta((y_n, x_n), (y_n, x_n), (y_{n-1}, x_{n-1})) + \delta((y_n, x_n), (y_n, x_n), (y_{n-1}, x_{n-1}))], \\ &\frac{1}{2}[\delta((y_{n+1}, x_{n+1}), (y_{n+1}, x_{n+1}), (y_{n-1}, x_{n-1})) + 0]\}) \end{aligned} \tag{3.4.4}$$

On using the notation of  $\beta$  given in the proof of Theorem 3.3, we have

$$\begin{aligned} &\beta((x_n, y_n), (x_n, y_n), (x_{n-1}, y_{n-1})) = \min\{\alpha((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n)), \\ &\alpha((y_n, x_n), (y_n, x_n), (y_{n-1}, x_{n-1}))\} \geq 1. \end{aligned} \tag{3.4.5}$$

by using (3.4.3), (3.4.4) and (3.4.5), we have

$$\begin{aligned} &G(F(x_{n-1}, y_{n-1}), F(x_n, y_n), F(x_n, y_n)) + G(F(y_n, x_n), F(y_n, x_n), F(y_{n-1}, x_{n-1})) \\ &\leq \beta((x_n, y_n), (x_n, y_n), (x_{n-1}, y_{n-1}))G(F(x_{n-1}, y_{n-1}), F(x_n, y_n), F(x_n, y_n)) \\ &+ G(F(y_n, x_n), F(y_n, x_n), F(y_{n-1}, x_{n-1})) \\ &\leq \alpha((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n))G(F(x_{n-1}, y_{n-1}), F(x_n, y_n), F(x_n, y_n)) \\ &+ \alpha((y_n, x_n), (y_n, x_n), (y_{n-1}, x_{n-1}))G(F(y_n, x_n), F(y_n, x_n), F(y_{n-1}, x_{n-1})) \\ &\leq \psi(\max\{\delta((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n)), \frac{1}{2}[\delta((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n)) \\ &+ \delta((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1}))], \frac{1}{2}[\delta((x_{n-1}, y_{n-1}), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1}))]\}) \\ &\leq \psi(\max\{\delta((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n)), \delta((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1})), \\ &\frac{1}{2}[\delta((x_{n-1}, y_{n-1}), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1}))]\}) \\ &\leq \psi(\max\{\delta((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n)), \delta((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1}))\}) \end{aligned}$$

$$\begin{aligned} &\text{It follows that } \delta((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1})) = G(x_n, x_{n+1}, x_{n+1}) + G(y_{n+1}, y_{n+1}, y_n) \\ &\leq \psi(\max\{\delta((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n)), \delta((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1}))\}). \end{aligned}$$

Since  $\psi(t) < t$  for  $t > 0$ , it follows that

$$\begin{aligned} &\delta((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1})) \leq \psi(\delta((x_{n-1}, y_{n-1}), (x_n, y_n), (x_n, y_n))) \\ &\leq \psi^2(\delta((x_{n-2}, y_{n-2}), (x_{n-1}, y_{n-1}), (x_{n-1}, y_{n-1}))) \\ &\vdots \\ &\leq \psi^n(\delta((x_0, y_0), (x_1, y_1), (x_1, y_1))). \end{aligned}$$

Therefore,  $\delta((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1})) \rightarrow 0$  as  $n \rightarrow \infty$

so that  $G(x_n, x_{n+1}, x_{n+1}) \rightarrow 0$  and  $G(y_{n+1}, y_{n+1}, y_n) \rightarrow 0$  as  $n \rightarrow \infty$ .

Let  $\epsilon > 0$  be given, Since  $\sum_{n=1}^{+\infty} \psi^n(\delta((x_0, y_0), (x_1, y_1), (x_1, y_1))) < \infty$  there exist  $N \in \mathbb{Z}^+$  such that

$$\sum_{p=n}^{+\infty} \psi^p(\delta((x_0, y_0), (x_1, y_1), (x_1, y_1))) < \epsilon \text{ for all } n \geq N(\epsilon).$$

Now we show that  $\{x_n\}$  is a Cauchy sequence in  $X$ .

Let  $m, n \in \mathbb{Z}^+$  with  $m > n \geq N$ .

$$\begin{aligned} G(x_n, x_m, x_m) &= G(x_n, x_{n+1}, x_{n+1}) + G(x_{n+1}, x_{n+1}, x_{n+2}) + \dots + G(x_{m-1}, x_{m-1}, x_m) \\ &\leq \psi^n(\delta((x_0, y_0), (x_1, y_1), (x_1, y_1))) + \dots + \psi^{m-1}(\delta((x_0, y_0), (x_1, y_1), (x_1, y_1))) \\ &\leq \sum_{p=n}^{+\infty} \psi^p G(x_0, x_1, x_1) < \epsilon \end{aligned}$$

i.e.,  $G(x_n, x_{n+k}, x_{n+k}) < \epsilon$  for all  $n+k, n \geq N$

Hence  $\{x_n\}$  is a Cauchy sequence in  $X$ .

Since  $X$  is complete, there exist  $x \in X$  such that

$$\lim_{n \rightarrow \infty} x_n = x \text{ Similarly we can prove that } \{y_n\} \text{ is a Cauchy sequence in } X.$$

Since  $X$  is complete, there exist  $y \in X$  such that  $\lim_{n \rightarrow \infty} y_n = y$

Thus,  $\{x_n\}$  and  $\{y_n\}$  are sequence in  $X$  such that

$$\alpha((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1})) \geq 1 \text{ and}$$

$$\alpha((y_{n+1}, x_{n+1}), (y_{n+1}, x_{n+1}), (y_n, x_n)) \geq 1$$

$\{x_n\} \rightarrow x \in X$  and  $\{y_n\} \rightarrow y \in X$  as  $n \rightarrow \infty$ .

By (iii) we get,  $\alpha((x_n, y_n), (x, y), (x, y)) \geq 1$  and  $\alpha((y, x), (y, x), (y_n, x_n)) \geq 1$  for all  $n$ .

Therefore  $T$  and  $\beta$  satisfy all the hypothesis of Theorem 3.4. Hence  $T$  has a fixed point and  $F$  has a coupled fixed point.  $\square$

Condition (H): For all  $(x, y), (u, v) \in X \times X$  there exists  $(z_1, z_2) \in X \times X$  such that  $\alpha((x, y), (z_1, z_2), (z_1, z_2)) \geq 1, \alpha((z_2, z_1), (z_2, z_1), (y, x)) \geq 1$  and  $\alpha((u, v), (z_1, z_2), (z_1, z_2)) \geq 1, \alpha((z_2, z_1), (z_2, z_1), (v, u)) \geq 1$

**Theorem 3.5.** *In addition to the hypotheses of Theorem 3.4. if condition (H) holds, then uniqueness of coupled fixed point of  $F$ .*

*Proof.* We show that  $T$  and  $\beta$  of Theorem 3.3 satisfy the hypotheses

Let  $x, y, u, v \in X$ , Then by using (H), we get

$$\beta((x, y), (z_1, z_2), (z_1, z_2)) = \min\{\alpha((x, y), (z_1, z_2), (z_1, z_2)), \alpha((z_2, z_1), (z_2, z_1), (y, x))\}$$

Similarly

$$\beta((u, v), (z_1, z_2), (z_1, z_2)) = \min\{\alpha((u, v), (z_1, z_2), (z_1, z_2)), \alpha((z_2, z_1), (z_2, z_1), (v, u))\}$$

Hence  $T$  and  $\beta$  satisfy the hypotheses of Theorem 3.3.  $T$  has a unique fixed point and consequently by Lemma 2.11 and  $F$  has a unique coupled fixed point.  $\square$

The following is an example in support of Theorem 3.3.

**Example 3.6.** Let  $(X, G)$  be a  $G$ -metric space, where  $X = [0, 1]$  and  $G(x, y, z) = |x - y| + |y - z| + |z - x|$  for all  $x, y, z \in X$ .

We define  $F : X \times X \rightarrow X$  by  $F(x, y) = \frac{1}{4}xy$  for all  $x, y \in X$ .

We define  $\alpha : X^2 \times X^2 \times X^2 \rightarrow X$  be such that

$$\alpha((x, y), (u, v), (u, v)) = \begin{cases} 1 & \text{if } x \geq u, y \leq v \\ 0 & \text{otherwise.} \end{cases}$$

Since  $|xy - uv| \leq |x - u| + |y - v|$  holds for all  $x, y, u, v \in X$ .

Suppose  $x \geq u, y \leq v$  then

$$\begin{aligned} \alpha((x, y), (u, v)(u, v))G(F(x, y), F(u, v), F(u, v)) &= 1.G\left(\frac{xy}{4}, \frac{uv}{4}, \frac{uv}{4}\right) \\ &= 2\left|\frac{xy}{4} - \frac{uv}{4}\right| \\ &\leq \frac{1}{2}(|x - u| + |y - v|) \\ &= \frac{1}{2}\psi(\max\{G(x, u, u) + G(y, v, v), \\ &\frac{1}{2}(G(x, F(x, y), F(x, y)) + G(y, F(y, x), F(y, x))) + (G(u, F(u, v), F(u, v)) \\ &+ G(v, F(v, u), F(v, u))), \frac{1}{2}(G(x, F(u, v), F(u, v)) + G(y, F(v, u), F(v, u))) \\ &+ (G(u, F(x, y), F(x, y)) + G(v, F(y, x), F(y, x)))\}) \end{aligned}$$

Thus for (3.1) holds for  $\psi(t) = \frac{t}{2}$ . Hence  $F$  is generalized  $(\alpha, \psi)$ -contractive map in two variable. and  $F$  is continuous. we choose  $x_0 = 0, y_0 = 0$  then  $F(x_0, y_0) = 0 = F(y_0, x_0)$   
 $\alpha((x_0, y_0), (F(x_0, y_0), (F(y_0, x_0)), (F(x_0, y_0), (F(y_0, x_0))) = 1$  and  
 $\alpha((F(y_0, x_0), (F(x_0, y_0)), (F(y_0, x_0), (F(x_0, y_0))(y_0, x_0))) = 1$   
 Hence, hypotheses of Theorem 3.3 satisfy. Then there exist coupled fixed point in  $F$ .  
 In this case (1,0) and (0,1) are the coupled fixed point of  $F$ .

This example is not necessary for this Theorem 3.4 and it has unique, it is sufficient condition for (H) condition.

**Example 3.7.** Let  $(X, G)$  be a  $G$ -metric space, where  $X = \mathbb{R}$  and  
 $G(x, y, z) = |x - y| + |y - z| + |z - x|$  for all  $x, y, z \in X$ .

$$\text{We define } F : X \times X \rightarrow X \text{ by } F(x, y) = \begin{cases} \frac{|x^2 - y^2|}{8} & \text{if } x, y \in [0, 1] \\ 1 & \text{otherwise.} \end{cases}$$

We define  $\alpha : X^2 \times X^2 \times X^2 \rightarrow X$  be such that

$$\alpha((x, y), (u, v), (u, v)) = \begin{cases} 1 & \text{if } x, y, u, v \in [0, 1] \\ 0 & \text{otherwise.} \end{cases}$$

Clearly  $F$  is not continuous at (1,1) and  $F$  is generalized  $(\alpha, \psi)$ -contractive map (i.e.,  $F$  satisfy equation(3.1)), with  $\psi(t) = \frac{t}{2}$  for all  $t > 0$ . In fact, for all  $x, y, u, v \in [0, 1]$  then

$$\begin{aligned} \alpha((x, y), (u, v)(u, v))G(F(x, y), F(u, v), F(u, v)) &= 2|F(x, y) - F(u, v)| \\ &= 2\left|\frac{|x^2 - y^2|}{8} - \frac{|u^2 - v^2|}{8}\right| \\ &= \frac{1}{4}\left||x^2 - y^2| - |u^2 - v^2|\right| \\ &\leq \frac{1}{4}|x^2 - y^2 - u^2 + v^2| \\ &\leq \frac{1}{4}|(x + u)(x - u) + (v + y)(v - y)| \\ &\leq \frac{1}{2}(|x - u| + |y - v|) \\ &= \frac{1}{2}\psi(\max\{G(x, u, u) + G(y, v, v), \end{aligned}$$

$$\begin{aligned} &\frac{1}{2}(G(x, F(x, y), F(x, y)) + G(y, F(y, x), F(y, x))) + (G(u, F(u, v), F(u, v)) \\ &+ G(v, F(v, u), F(v, u))), \frac{1}{2}(G(x, F(u, v), F(u, v)) + G(y, F(v, u), F(v, u))) \\ &+ (G(u, F(x, y), F(x, y)) + G(v, F(y, x), F(y, x)))\}) \end{aligned}$$

Suppose at least one of the  $x, y, u, v \in [0, 1]$  then we have that  $\alpha((x, y), (u, v)(u, v)) = 0$  and hence both side tends to zero. so that (3.4) holds for all  $(x, y), (u, v) \in X \times X$  clearly (i) hold, we choose  $x_0 = \frac{1}{5}$  and  $y_0 = \frac{4}{5}$  it hold (ii).

Let  $\{x_n\}$  and  $\{y_n\}$  are sequence of  $X$  such that

$$\alpha((x_n, y_n), (x_{n+1}, y_{n+1}), (x_{n+1}, y_{n+1})) \geq 1 \Rightarrow \{x_n\}, \{y_n\} \text{ are sequence in } [0,1]$$

similarly  $\alpha((y_{n+1}, x_{n+1}), (y_{n+1}, x_{n+1}), (y_n, x_n)) \geq 1 \Rightarrow \{y_n\}, \{x_n\}$  are sequence in  $[0,1]$

Let  $\{x_n\} \rightarrow x$  and  $\{y_n\} \rightarrow y$ . Since  $[0,1]$  is closed we have  $x, y \in [0, 1]$   
Therefore  $\alpha((x_n, y_n), (x, y), (x, y)) \geq 1$  and  $\alpha((y, x), (y, x), (y_n, x_n)) \geq 1$   
so that (iii) holds. Therefore  $F, \alpha$  and  $\psi$  satisfy all the hypotheses of Theorem 3.4  
and  $(0,0)$  is a coupled fixed point of  $F$ .

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# “Shopping Helper”: Automated Navigation Application for Easy Shopping

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**Abstract**-Shopping for household items is a tedious task since different members of a family will have different needs. If each member decides to go for shopping individually, it might be inefficient and time consuming. Some might prefer going to a shopping mall to purchase all the items that they need but since technology like Global Positioning System (GPS) doesn't work indoors accurately, people will find it difficult to navigate to the required store. Sometimes the user might find several items that fits the requirements and might have difficulties trying to choose between them. The purpose of this research is to overcome such issues and improve the overall experience of shopping with the use of an android application. This application would allow the users within a family to create and share a shopping list so that one member of the family could purchase items needed for the entire family. The application also helps the user to navigate to the store that sells those items within a shopping mall using Bluetooth low energy (BLE) beacons. Other functionalities of this application would be to be notified about the offers available at the stores based on the user as they enter a store and also to scan the barcodes of the items available and share reviews about those items. These reviews will be sorted using an algorithm so that others would find it easy when making purchasing decisions.

**Index Terms**-Android, Shopping list, Indoor navigation, Bluetooth Beacon, Barcode scanner, review sorting algorithm, customized notifications

## I. INTRODUCTION

The needs and wants of each family member might vary and if each one of them decides to go for shopping individually, it might be inefficient and if only one member decides to go shopping for the entire family, there might be confusion about buying which item to whom. This could also result in some members buying the same item more than once, unnecessarily. This will increase the cost of the entire family.

Once the shopping needs of the members have been sorted, the next issue would be about where to find which item in the shopping list. The buyer might have to visit several stores unnecessarily to find the items in the shopping list if the buyer doesn't know where to buy a certain item. Even if the member got to know where to buy a certain item, he/she might have difficulties locating that store.

Since almost anything can be purchased at shopping malls these days, buyers might prefer going there to fulfill all of their shopping needs as it would be more efficient but since GPS doesn't work well indoors, other forms of indoor navigation has to be looked into in order to allow a user to navigate within a shopping mall

Sometimes the user might find several items that fits the requirements and might find difficulties trying to choose the correct item. The user wouldn't have the option to get to know what others think about each item so that he/she might be able to make the purchasing decision with ease.

The shop owners also have difficulties in attracting customers and communicating certain information for specific types of customers so that their resources are spent efficiently and customers would not be annoyed by unnecessary and irrelevant information from the shops.

“Shopping Helper” is an android application with an overall objective of improving the shopping experience by overcoming all of the above mentioned problems. “Shopping Helper” would allow the users to share shopping lists with their family members and based on the items added to the shopping list, the application should navigate the user to the shops which sell those items. The application would also notify the users with offers available at stores based on certain conditions such as age, gender and user's interest in a that item when they enter a particular store as well as to allow the users to use the application and scan the barcode of the items in the store in order to get more details about those items and add or view reviews about those items.

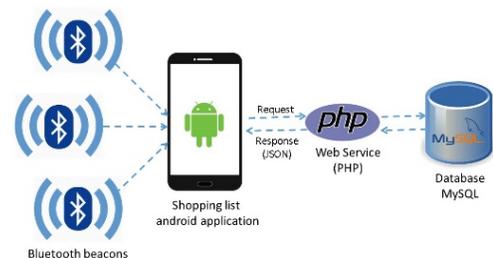


Figure 1: High Level Architecture Diagram

Figure 1 illustrates the high level architecture diagram of the system where the users can manage the data and their shopping list. As shown in the diagram the database that was chosen to store data was MySQL database and PHP was used to access that database. Bluetooth beacons would be placed around the shopping mall to enable indoor navigation. Signals received from these beacons would help the system decide user's location.

The research paper discusses about background and related work in the second chapter. Third chapter discusses the methodology that was used to develop a prototype system. Fourth chapter discusses about the implemented system. Fifth chapter discusses about the issues faced during the development of the system. The conclusion that was derived and the limitations are

discussed in the sixth chapter. Future work is discussed in the eighth chapter.

## II. BACKGROUND

With the increase of smartphone development, the ways in which these smartphones can improve the lives of people have become limitless. One of the areas in which these smartphone applications can be used is to help the users keep track of the items that they need to purchase. Another way in which the smartphones can be used is to help the users navigate around and the most popular method in navigation is GPS. GPS is able to accurately locate the position of the users if the user is outdoors but when the user is indoors, due to the inability to get the line of sight from the satellites, makes it unusable indoors. Therefore, to assist the users find the location of the stores indoors, other methods of indoor navigation needs to be looked into. Cameras in the smartphones can be used as barcode scanners and this can be helpful for shoppers since users can scan the barcode of the item and get to know details about it. The users can also share reviews about the items so that it can be helpful for others when they cannot decide on which item to purchase.

There is no specific application which resembles “Shopping Helper” directly but there are several shopping list application and some of the do allow the users to share their shopping list with others but none of the shopping list applications available in the play store allow the users to navigate to the stores to purchase items or to allow the users to scan the barcode of the item and display details about it.

“Out of Milk Shopping List” is an android shopping list application which automatically calculates the grand total of all the items that you have added but the drawback is that some of the features are only limited within United States [1]. “Smart Shopping List – Listonic” is another android shopping list application with a unique feature which provides useful tips to the users regarding buying, preserving, and cooking to help its users make the most out of the groceries [2]. “Bring! Shopping List” is another shopping list app with support for android wear smartwatches [3].

BeaSmart, is a mobile application that has been deployed and tested in the IBM Almaden Research Center (ARC) which can be used to detect iBeacons. The application has different user perspectives for employees and visitors of ARC. The features of BeaSmart are a Stockroom Assistant, Role-based Navigation Guide, Differential Temperature Control, and Location-based Notifications [4].

Bluepass is an indoor Bluetooth-based localization system that relies on the RSSI (received signal strength indicator). The system main goal was to allow users in a given environment to locate and be located by other users through their mobile devices. The program that detects Bluetooth devices in its range runs on a PC USB Bluetooth adapter [5].

A system that can be used to easily locate newborn babies in hospital was developed using iBeacons, a Bluetooth Low Energy (BLE) based technology. The system works by putting an iBeacon on every baby’s leg and use the iBeacon to broadcast

the unique ID information, which can identify babies on users’ smart phone [6]. Another system where iBeacons are used in hospital was proposed where the system helps the patients to find their departments or wards when seeing doctor or patient using shortest distance algorithm Floyd [12].

A research on the minimum number of beacons needed and where to locate them in order to locate a user in an area for maximum accuracy was done and was found out that having, five iBeacons gives the best performance. However, the improvement from three iBeacons to four iBeacons is significant while the improvement from four iBeacons to five iBeacons is negligible. Therefore, having four iBeacons in the middle area contains the highest efficiency [6].

To measure the position of the user a using Bluetooth, a process called Trilateration can be used which works by using at least three different Bluetooth transmitters to transmit Bluetooth signal and measure the distance from the beacon to the user to estimate the position of the user. A map overlay will be created to visually represent the position of the users by measuring the distance from the transmitters [4] [5] [6] [11].

Fingerprinting is another technique used for localization which requires offline calibration phase to build a radio map primitively. The building of the radio map involves collecting a multiple RSS of each access points or transmitters at every possible location in indoor environment. Since it is infeasible to collect RSSI at every possible location, the floor layout can be divided into grids. Within each grid, a signal vector of access points’ associated readings are collected [7] [8].

Mobile Barcode Scanning Applications was built which enabled consumers to share comments and ratings of products after scanning the product’s barcode. Consumers have access to other opinions about products via their smartphone and can share their own product experience with other consumers [10].

“ShopSavvy Barcode & QR Scanner” is an android application which allows users to scan barcodes of products and show which stores sells those items at which price along with the details of the products and help users decide where to buy those items for the cheapest price. It also notifies the users if there are sales at different stores by analyzing the different websites [9].

Most of the currently available shopping lists applications are mostly concerned on only providing basic features such as creating shopping lists to the user while few applications offer few unique features but none of the applications offer features like locating and directing users to the shops which sell the items listed in the shopping list. There are several ways to locate a store outdoors using GPS but there aren’t any ways for users to locate or navigate to shops, indoors. There are few barcode scanning applications which allow the users to scan items and get to know details about it but there aren’t any shopping list applications that has integrated this feature into it.

Therefore “Shopping Helper” fills the above mentioned gap by creating a shopping list application which allows the users to share their shopping list with their family members and also to locate the items found on the shopping list by using Bluetooth

beacon navigation and also to allow the users to scan the bar code of available products and share reviews about those products which will help others to make decisions regarding purchasing it

### III. METHODOLOGY

Prototype methodology was selected as the methodology in order to develop “Shopping Helper”. Analysis, Designing and Implementation phases were executed concurrently and iteratively until all requirements were gathered and implemented in a manner where system fulfills all the functional and nonfunctional requirements of the system. The initial prototype was built with less amount of features, where then it was developed upon and features were added in every prototypes. This procedure helped the research group to be more accurate about requirements and was also helpful to figure out the defects and fine tune the functions which was developed.

#### A. Planning

Planning phase was started at the initiation of the project where the research group understood the system to be developed and how it can be built. Scope, problems and the objectives were discussed among group members in order to identify them accurately. A feasibility analysis was done to make sure that the project was feasible.

#### B. Requirement Gathering and Analysis

Analysis phase focused on gathering information and analyzing the difficulties faced by the shoppers in modern days which paved the way to develop the requirements of the system. Data sources which were used to gather data were categorized as primary and secondary data sources. As primary data source, an online questionnaire was created and distributed among public in order to obtain people’s opinion about shopping and how it could be improved. The questionnaire contained only closed ended questions since most people preferred it. The gathered information from primary data source were more helpful to get a better understanding about the people’s needs. Whereas secondary data are gathered from research journals, articles, book etc. The data gathered through research papers are discussed in detail in the previous section.

#### C. Design

The primary objective of the design phase was to create a design that satisfies the agreed application requirements. Initially overall design was done starting with the High level architecture diagram (Figure 1). Thereafter the physical design of the system was done which included the actual input and output process of the system. There will be Bluetooth signals transmitted from beacons and these will act as inputs to detect the location of the user. The barcode of the items available at the store will also act as input since they will be scanned using the smart phone’s camera. Data from the database would also act as input for certain processes and all the other input will be touch inputs. These touch inputs will be performed via keyboard or the screen. All the outputs will be displayed on the screen.

Secondly the interface design was done which defined how the user interacts with the system including inputs and outputs of the system. The user interface was designed to be more understandable and easy to navigate. When designing UI, basic principles were followed such as the layout, aesthetics, content awareness, user experience, consistency and minimum user effort. Finally, the database design was done which defined how the data was to be stored in the database. Number of tables, relationships between each table, primary keys, foreign keys etc. were decided in this process.

#### D. Implementation

Implementation is the fourth stage of the SDLC where the project team transformed the design into a working system. Android studio was the IDE which was used to build “Shopping Helper” and several libraries were used to add the functionalizes required as well as to improve the performance of the system and ease the development of the application.

Since the users needed to share their shopping list with one another, the database had to be stored externally and for this purpose, MySQL database was chosen. To Communicate and integrate with the database, PHP scripts were used and this along with the database was hosted on Amazon Web Services.

For indoor navigation, Estimote branded Bluetooth beacons were used and the Software Development Kit (SDK) which was used to communicate with these beacons was Steerpath version 2.5. This SDK allowed the team to create a map for navigation using a Computer Aided Design(CAD) application called DraftSight and easily integrate it into the application. The beacons will transmit a Bluetooth signal continuously which will be read by the user’s device. Along with the signals, a Major and Minor values will be transmitted which will help the system to identify from which beacon, the signal is being transmitted and the and the signal strength of these signals were used to estimate the location of the user within the shopping mall.

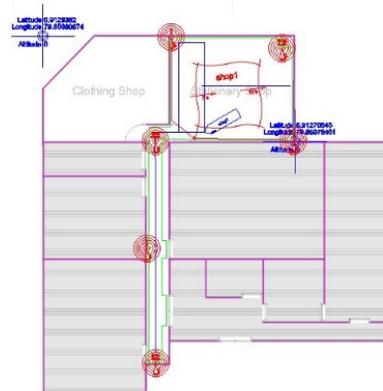


Figure 2: Indoor map for navigation

For location based notifications, a separate web interface was created for the shop owners where they can manage the notification message as well as the condition for the notification to appear on the user’s phone. When the user enters a shop, a trigger will be triggered and a request would be sent to the server

along with the user’s details and the shop ID. The server will sort out the notification suitable for the user and respond.

In order to identify items, found in the shops using barcode, Zxing library was used and once the item was scanned, the item description along with the reviews given for that item would be retrieved from the server and displayed to the user. These item details can also be managed by the shop owners through the web interface.

In order to sort the reviews made by the users, an algorithm called Grubb’s Test was used [14]. This works by analyzing the ratings given for that item in the review and remove the reviews found to be outliers. Grubbs' test is a statistical test used to detect outliers in a data set assumed to come from a normally distributed population. Grubbs' test detects one outlier at a time. This outlier is expunged from the dataset and the test is iterated until no outliers are detected.

Following is the formula of the algorithm where  $Y_i$  is the value which we are testing for being an outlier or not.  $\bar{Y}$  is the mean or average of the dataset.  $S$  is the standard deviation of the dataset.  $N$  is the number of elements in the dataset.  $t_{\alpha/(2N),N-2}$  is the critical value of the t-distribution with  $N - 2$  degrees of freedom and a significance level of  $\alpha/(2N)$ . If the condition is found to be true, the record belonging to the  $Y_i$  value will be removed and the dataset will be checked for outlier again until no outliers are found

$$\frac{|Y_i - \bar{Y}|}{s} > \frac{(N - 1)}{\sqrt{N}} \sqrt{\frac{(t_{\alpha/(2N),N-2})^2}{N - 2 + (t_{\alpha/(2N),N-2})^2}}$$

### E. Testing

During the testing phase, the following testing were performed in order to test the functionality as well as to identify defects of the system which would result in a system with better quality, performance and accuracy.

- Unit testing is where the smallest testable parts of an application called units, which are individually and independently analyzed for proper operation.
- Integration testing focuses on testing whether the set of modules functions together without errors. Data flow and the data exchange between modules is mainly focused on this testing.
- System testing is where the completed and integrated system is tested to verify that the system meets functional and non-functional requirements.

## IV. RESULTS

“Shopping helper” is an android application focusing on improving the shopping experience by providing several functionalizes such as a family shopping list, indoor navigation within a shopping mall, customized notification based on user’s location, item identification using barcodes and sharing reviews of those items.

Family shopping list is one of the fundamental functionalities of “Shopping helper” which allows the user to share shopping list items with their family members in order to make shopping more efficient and effective. Figure 3 shows the implementation of this functionality

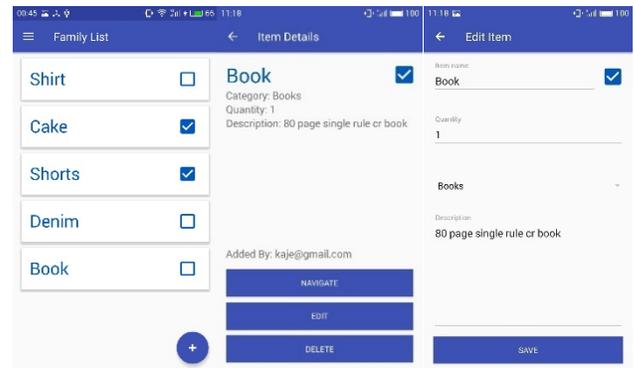


Figure 3: Family shopping list interface

Indoor navigation functionality of “Shopping helper” allows the user to locate themselves within the shopping as well as to locate and navigate to the stores which sell the items added to the shopping list. Figure 4 shows the implementation of this functionality. Steerpath SDK was used to implement the indoor navigation functionality.

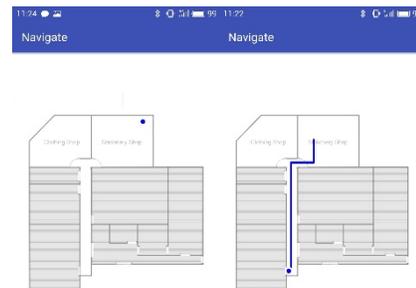


Figure 4: Indoor navigation interface

Barcode scanning functionality of “Shopping helper” allows to scan and identify the details of the items found in the shopping mall as well as to share reviews about those items which would help the users to make purchasing decisions. The reviews added by the users would also be sorted using “Grubbs test” algorithm so that users would not be confused by any peculiar reviews. Figure 5 shows the implementation of the barcode scanning interface as well as the item details and review adding interface.

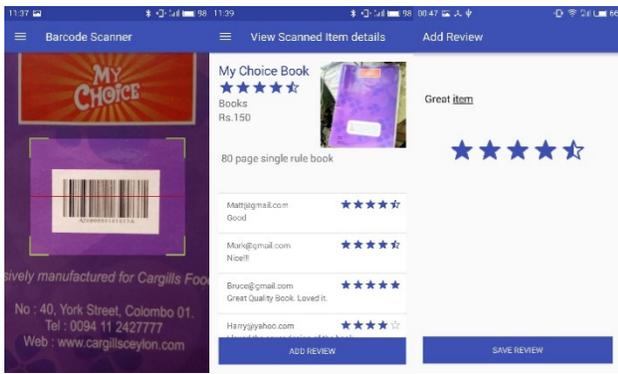


Figure 5:Barcode scanning and review sharing interface

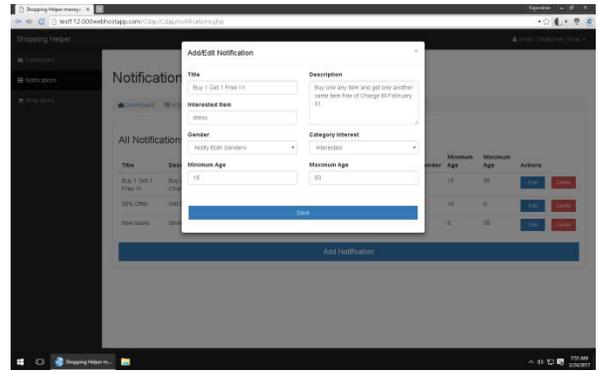


Figure 8: Notification add/edit interface

Customized notification functionality of “Shopping Helper” allows the shop owners to create notifications specific for users by creating certain conditions for the notifications to be appeared on the user’s phone when the user enters the shop. These notification conditions were based on user’s age, gender, user’s interest in the category of the shop that he/she entered and based on user’s interest in a specific item. A separate interface was created and provided for the shop owners to manage these notifications. Figure 6 shows a sample notification appearing on the user’s phone.

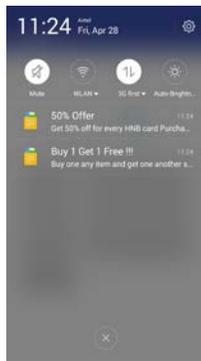


Figure 6: Received Notification

Figure 7 and Figure 8 shows the interface provided for the shop owners to manage the notifications.

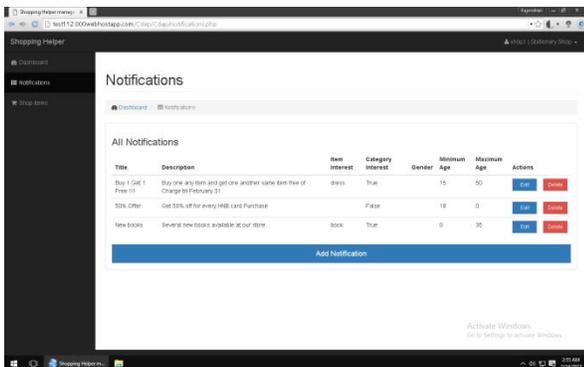


Figure 7: Notification Management interface

During the testing phase, it was found out that the accuracy and reliability of the system was 95.65% and the cause for not achieving 100% was due to the indoor navigation functionality where the accuracy of user’s positioning varied depending on the user’s position. This was due to accuracy of bluetooth beacons being low which couldn’t be improved.

## V. DISCUSSION

“Shopping Helper” was developed with an overall objective to improve the shopping experience of family members and through the implemented system, family members can enjoy a more efficient and effective shopping experience.

While developing the system, the team had to experience some technical issues and following are those issues along with how the team managed to overcome those issues.

The most important issue was the level of accuracy of indoor navigation using Bluetooth beacons. The reason for this issue is that the location of the user is measured based on the signal strength received from the beacons and when a user is at a particular location the signal strength from the beacon kept on varying. The accuracy of navigation was acceptable when user was walking along a straight path but not when the user was in an open area. In order to improve the accuracy, the signal transmitting interval of the beacons were reduced. This improved the accuracy up to a certain extent but did not eradicate the issue completely.

Selecting an algorithm for sorting out peculiar reviews when showing the scanned item details was also an issue since there were several outlier detection algorithms with similar level of accuracy. We decided to choose Grubbs test algorithm since it was known to produce accurate results even with low number of records to check for outliers.

The assumptions made when developing the system are as follows,

- User has a basic knowledge of using android smartphone applications.
- User is within the mapped area when using indoor navigation

## VI. CONCLUSION

As with the increasing popularity of shopping, the issues faced by modern shoppers have become more obvious and “Shopping Helper” has proved to be capable of solving these issues as well as to improve the overall shopping experience and to make shopping more enjoyable. Family members will no longer have to worry whether other members are aware of your needs and wants as they will be able to share it using this application so that one member can do the shopping for the entire family and be more efficient. The users will no longer have to waste time on finding the required shops and locate the needed shops with ease. When purchasing items on the shopping list, the users would no longer have to be confused on which item to choose when there are already reviews given by previous buyers regarding the product. Shop owners would no longer have trouble communicating and attracting the right customers as they will be able to target customers based on required condition and customers will no longer have to be annoyed by irrelevant notifications. Overall, this system has been capable of improving the efficiency and productivity in creating, sharing, locating and purchasing items needed for day to day life.

Following are the limitations that were figured out about “Shopping Helper” by the development team when developing the system.

- One of the main limitation is that if the user is outside the mapped area but still receive the Bluetooth signals from the beacons, the system will assume that the user is within the mapped area. The only solution for this would be to map every area that the user can reach which might be costly.
- Bluetooth beacon based navigation cannot be used on phones with android version below 4.3 as Bluetooth beacons support for android was only introduced with android version 4.3
- Bluetooth beacon based navigation only has an average accuracy of 4 meters and this can sometimes become worse depending on the location of the user and the placement of the beacons.
- Since “Steerpath” SDK was used for indoor navigation, the developers were restricted by functions available in the library.
- Even though Grubbs test algorithm works well even with a few number of records, it still needs at least 6 records to perform most accurately.

## VII. FUTURE WORK

Following are some of the recommendations for future work for any parties who are interested in developing this system further

- Allow the users to select which items to be shared with which member of the family
- To use other indoor navigational techniques such as WI-FI and Geomagnetic readings to improve the accuracy.
- The System could be made compatible with other operating systems such as IOS, Windows, Blackberry and etc.
- Add GPS support so that the app would allow the user to navigate even when outside the shopping mall.

- Have an algorithm which would allow the user to go to the required shops in a sequence so that they will be spending the least amount of time.
- Add further conditions to sort out the notifications for the users

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# Population Size, habitat association of Common Warthog (*Phacochoerus africanus*) and their impact on agricultural crops around Diregudo forest in Gololcha woreda, South East, Ethiopia

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**Abstract-** The study deals with the population size, habitat association of common warthog (*Phacochoerus africanus*) and their impact on agricultural crops was carried out in Diregudo forest. To conduct the animal survey the forest were divided in to three habitats namely mixed grass land, bush land and wood land. Depending on the vegetation type representative habitats were randomly selected in each habitat animal survey was conducted using line transects. Fifteen line transects were laid down and along each line transect animal survey was conducted. The study was carried out by means of a semi-structured questionnaire along with one focus group discussion at each kebele was held. For data analysis SPSS version 19 computer software and descriptive statistics were used. During study period the maximum number of common warthog recorded was 50 during the wet season and the lowest 41 during the dry season. The highest population was observed in Koji mixed grassland (43) accompanied by Qumbile Bush land (28) and the lowest population was observed in laga allo wood land (20 during wet and dry season). The present study indicates that 18.68%, of warthog population was adult male, 23.08%, of the warthog population was sub adult female, 27.47% was adult female and 16.48% of the population was young ones. Age category was recognized as important factor for the attitude of communities towards the reserve area. The majority of 59 % of the respondents > 59 age group had negative attitude towards the forest. 43.2% of illiterate respondents show the negative attitude towards protected area and the high school and elementary educational level had positive attitude towards the reserve area. Damaging crops by the Warthog resulted in the majority (69.86 %) of respondents to reflect as a harmful animal on their livelihood. Furthermore, the common warthog damage crop both day and night time. Wheat is the second preferable crop next to maize. Guarding was considered as the most and successful defensive way to reducing the damage of their crops from the animal in the area. Encroachment activities from the people have the greatest challenge to the survival of the warthog in the forest. If not prominent action is taken to solve the problems, the forest will no longer act as conservation area. Because of this the right conservation procedures have to be made and the way community became benefited from conservation in various ways

**Index Terms-** impact on agricultural crops, habitat association, population size warthog.

## I. INTRODUCTION

### 1.1. Background of the Study

Common Warthog (*Phacochoerus africanus*) is found in many parts of sub-Saharan Africa. Common Warthogs are the only African pigs which are typical open country species, as evidenced by characteristic grazer morphology and behavior. Even though they are mostly grazers, their diet is not restricted to grass, such as roots, fruit, and small mammals, reptiles, and birds. They are restricted to various types of savanna grasslands, open bush lands, and woodlands, usually not far from nearby water source (d'Huart *et al.*, 2011). The transformation of this wood lands, forests, savannah and other ecosystems into agrarian areas or urban agglomerates as a consequence of the increasing demand for land, food production, energy and raw materials, has led to a dramatic decrease in wildlife habitats (Eyebe *et al.*, 2012). The gradual loss of habitat has led to increasing conflict between humans and wildlife (Edward Frank, 2012).

Common warthogs (*Phacochoerus africanus*) are inhibited on the savannah grasslands in almost all of Africa's sub-Saharan countries (Berger *et al.*, 2006). Warthogs have missing in some areas where the human population is growing and are therefore in some countries found only in reserve areas (Muwanika *et al.*, 2006). They are non-migratory and vigorous during the day and they sleep in holes commonly abandoned by other animals during the night (d'Huart & Grubb, 2001). Females live in small family groups with their offspring and the males live lonely or in single groups (Berger *et al.*, 2006). The common warthog (*P. africanus*), is found mainly in eastern Ethiopia, Somalia and northern Kenya (Sommerlatte and Umar 2000).

Wildlife protection is a complex challenge currently being faced by the conversationalists around the world (Eniang *et al.*, 2011). In view of the fact that nowadays there is no corner of this earth where human wildlife conflict does not exist in one form of another (USDA, 2004). However it is more intense in tropics and in developing countries, where husbandry and crop production are important activities of farmers livelihoods and earnings (Treves *et al.*, 2006). The adverse impacts of human wildlife conflict on environment and wildlife conservation activities are the clearing of vegetation that resulted for the loss of wildlife habitat that forcing animals to crop distraction, followed by decline in wildlife populations (Treves *et al.*, 2006). Agricultural activities are expanding that leads to forests encroachment, habitat destruction and further to human wildlife conflict which in turn lead the farmers have increasingly lost crops to pests/problem causing animals (Joseline, 2010). Common warthogs are also well-known to cause damage to deferent crops ([African Wildlife Foundation, 2005](#)).

Largely, crop raiding is the main sources of conflict between wild animal and rural people in the world (Distefano *et al.*, 2010). Which includes wildlife moving from their natural habitat on to agricultural land to feed on the crops that humans grow for their own consumption (Ojo *et al.*, 2010) Primate crop-raiding has been recorded in at least 73 species in nearly all range countries varying from raiding small garden crops to raiding commercial plantations (Warren, 2003). Warthogs are also identified to cause of damage to varies agricultural crops like wheat and peanut crops ([African Wildlife Foundation, 2005](#)). Competition for food between human and non-human primates can have significant impact on both agricultural yields and human nutritional status (Fuentes, 2006). Because of this communities perceive conservation of wildlife and their habitat often negatively. Moreover they are not willing of participating in preservation. For the reason that, rather than they getting immediate benefit from conservation they are repeatedly affected by their negative impact (Thorton *et al.*, 2006). The people within and around Diregudo forest are small scale farmers who entirely depend on subsistence agriculture for their livelihoods. Because of this some farmers around Diregudo complain that the wild mammals such as warthog, Bush pig, Baboon etc are damaging their crops like wheat, burly, maize and other crops. Therefore, the present study was initiated to assess the population size habitat association and the various dimensions of warthog impact on agricultural crops in the area.

## II. MATERIAL AND METHODS

### 3.1. Description of the Study Area

The study was conducted in Bale zone, Diregudo forest along with sub part of Kubayo forest is located in south-eastern of Ethiopia, which is located very close to Jara town in Gololcha district, (Figure 1) and is located at 7°N-7.5' N latitude and 40°E -4.5'E longitude with and an elevation of 2000-2300. The study area covers 1424ha.

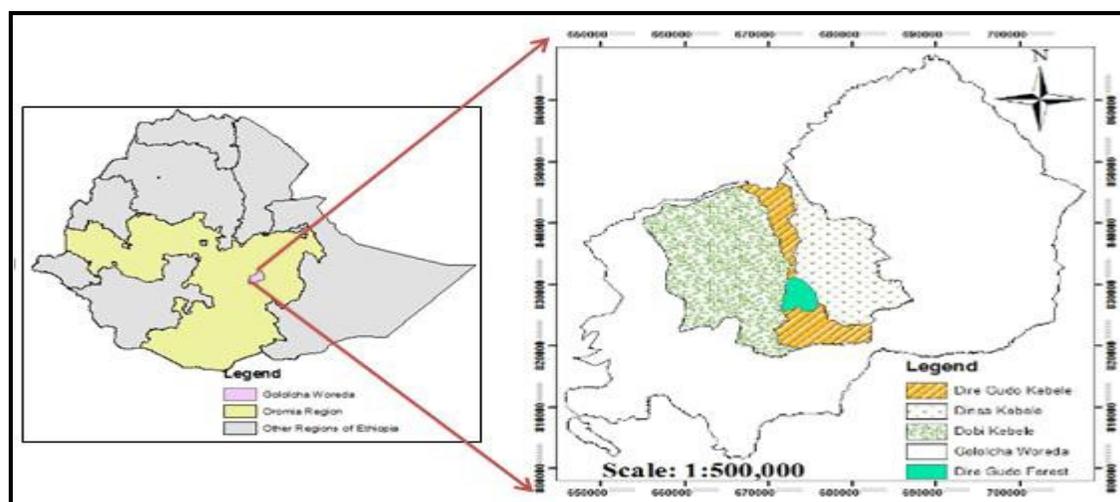


Fig 1 Map of the study area

### 3.2. Materials and Methods

#### 3.2.1. Materials Used

Materials used for the study comprise: note book, pen, calculator, binocular microscope, digital camera, GPS, field guides, data sheets, Sleeping bag and rain coat.

#### 3.2.2. Methods

### 3.2.2.1. Reconnaissance survey

Initial field visit was carried out during January 2015. This is to become familiar with the study area such as geographical situation and social structure. It also helps to identify socio-economic and bio-physical conditions of community. Similarly, this will frequent to visits to the area, because the environment is created to come closer and work with local people.

### 3.2.2.2. Sampling design

Based on the topography and vegetation types, the total area of the study was divided into three different habitat types namely mixed grass land, Bush land, and wood land. The study area includes 14.24 km<sup>2</sup>. Consequently, the sampling area covers about 39.82% of the study area. Based on the vegetation types and area of the habitat the sampling area of mixed grassland comprises about 1.6km<sup>2</sup>, bush land comprises about 2.304km<sup>2</sup>, while wood land comprises about 1.77km<sup>2</sup>. Based on natural and artificial boundary Fifteen (15) line transects were laid down randomly in the study area. In Koji mixed grass land four transects averagely with the length of 2km and widths of 200m were laid down. In Qumbile bush land a total of six transects averagely with the length of 3.2km and width of 120m were laid down. While in Lagaallo wood land five transects averagely with the length of 2.36km and width of 150m were laid down. Survey was made during the daytime with the help of three trained scouts. During the survey of common warthog, detailed observations were made. This is used to categorize the populations into their related age groups.

Information on the approximate demographic composition and structure, such as age class and sex ratio, was used to predict the general trend of common warthog population to understand whether it is declining, increasing or stable. The density of animal in the study area was also calculated. This provided the information on the preference of common warthog.

For questioner survey, the study applied a simplified formula provided by Yamane (1967:886) as used by

Israel, (1992) to determine the required sample size at 95% confidence level, and 5% level of precision.

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

Where, n=sample size

N= total population

e= precision level (sampling error) Where, n=? N= 3173

Therefore, 355 households were selected from the three peasant association for the questioner survey.

### 3.2.2.3. Data Collection

Based on the topography and habitat type, the total area was divided in to three habitats based on artificial and natural boundaries. In each habitat, line transect sampling technique was carried out to investigate the habitat preference of common warthog. Both dry and wet seasons were included. Data were also gathered by semi-structured interview, focus group discussion and direct observations.

#### 3.2.2.3.1. Animal Survey

Survey was carried out using direct observation by using binoculars on foot during the study period. Animal survey was conducted when common warthog is most active with good visibility in the morning (6.00–10.30 hours) and in the afternoon (17-18 hours) (Tewdros Kumssa and Afework Bekele, 2008). The population estimation of Common warthogs in Diregudo was conducted by sample survey using line transect method. Data on the sex and age category were also collected following methods (Laws and Clough 1966, 1969) to predict the population probability of common warthog in the future. The categories used were adult male and adult female, sub adult male and female, and young.

#### 3.2.2.3.2. Questionnaire survey

The present study was carried out by means of a semi structured questionnaire. The household data was collected using a semi-structured survey design, following a similar format to that used by Maddox (2003). The questionnaire was administered to farmers within their farm and/or residence (Hill, 2000), at a random manner based, and different age groups. To assess impacts of common warthog on agricultural crops around the forest, a standard questionnaire survey was conducted on the settlers in and around the forest. The actual data collection was carried out on 355 households (11% of local community). The questionnaire was designed to understand overall situation of the warthog impact on agricultural crop at a distance from the

protected area boundary and their impact on the conservation area within the range of 0–6 km. The data collected from sampled households using questionnaire was about household characteristics, farmer's perception and problems of the pest condition, the attitude of individuals towards the animals in & around the forest.

#### **3.2.2.3.3. Focus group discussion**

Focus group discussions and open-ended responses were held in the peasant associations to discuss the issues. Three group discussions (one at each kebele) were conducted. At each group comprises 15-20 individuals. During group discussions, the investigator was began the discussion by stating some of the clarification and responses from people interviewed and from questionnaires. The meetings were held with the kebele leaders and Barcha conservation cooperation leaders. Focus group discussion was composed of participants, comprising of village members who are aware on the history and patterns of settlement in the village, population size of common warthog and its impact on agricultural crops. Group discussions were used as a complement for the questionnaires. Participants were selected based on their age and duration of residency in the area. Participants were invited to discuss issues according to their convenience. Information collected from group discussion was collated and summarized using a text analysis method, and is presented in a narrative fashion.

#### **3.2.3. Method of Data Analysis**

Various techniques were used for the analyses and presentation of the data. The collected data was analyzed using SPSS version 19 and descriptive statistics and chi square were used. Animal density was analyzed using the formula.

$$D = \frac{N}{a}$$

Where D=density

N=Number of individual animal and

a= Sample area

### III. RESULTS

#### 4.1. Population Estimation of Common Warthog

Division of the study period into wet and dry seasons was vital in order to examine the influence of the seasons on the vegetation cover and thus on the distribution of the wildlife. Table 1 indicates the common warthog observed in different habitat during the present investigation. The maximum number of common warthog recorded was 50 during the wet season and the lowest 41 during the dry season. Table 1 revealed that the highest population was recorded during August and the lowest in January. On the other hand 24 warthogs during wet season and 19 warthogs were observed during dry seasons in Koji grass land. Data of the animal survey in Qumbile Bush land given in Table 1 revealed the presence of 15 and 13 warthogs during wet and dry season respectively in the area. In addition to these, only 11 warthog during wet and 9 warthogs during dry season were observed in laga allo wood land. But the number of individual animal during wet season was not statistically significant ( $\chi^2 = 5.3$ ,  $df = 2$ ,  $P > 0.05$ ).

**Table 1 Common warthog recorded in the study area during wet and dry seasons**

Season	Koji Grassland	mixed	Qumbile Bush land	Lagaallo wood land	Total
Wet season(July to October)	24	15	11		50
Dry season(December to January)	19	13	9		41
Total/Average	21.5	14	10		45.5

#### 4.1.1. Sex age structure

The number of adult male, adult female, sub adult male, sub adult female and young of common warthog in the whole study area was 17, 25, 13, 21, 15, respectively. Adult male comprised 18.68%, adult female 27.47%, sub adult male 14.29%, sub adult female 23.08% and young 16.48% (Table 4). Entirely 46 females, 30 males, and 15 young were observed both during wet and dry season. However; the largest number of female sex group did not show statically significant differences. ( $\chi^2 = 0.34$ ,  $df = 1$ ,  $P > 0.05$ ).

**Table 2 Sex age structure**

Damage category	Age and sex category							
Season	AM	AF	SAM	SAF	Young	Total		
Wet season(July to October)			9	13	8	12	10	50
Dry season(December to January)			8	12	5	9	5	41
Total/Average			17	25	13	21	15	91

(AM=Adult male, AF=Adult female, SAM=Sub adult male, SAF=Sub adult female)

#### 4.1.2. Sex and age ratio

The sex and age ratio of Common warthog is given in Table 3. The sex ratio of adult male to adult female was 1.00:1.4. The sub adult male to sub adult female sex ratio was 1.00:1.5, male to female was 1.00:1.4, sub adult male to adult male was 1.8:1, sub adult female to adult female was 1.00:1.08 and adult male to adult female was 1.00:1.5. The sub adult male to sub adult female sex ratio was 1.00:1.8, male to female was 1.00:1.6, sub adult male to adult male was 1.00:1.6; sub adult female to adult female was 1.00:1.3 during wet and dry season respectively. There was no statically significant difference ( $\chi^2=0.02$ ,  $df = 1$ ,  $P > 0.05$ ) between males and females.

**Table 3 Sex and age ratio**

Season	Sex and age ratio				
	AM:AF	SAM:SAF	M:F	SAM: AM	SAF:AF
<b>Wet season(July to October)</b>	1.00:1.4	1.00:1.5	1.00:1.4	1.8:1	1.00:1.08
<b>Dry season(December to January)</b>	1.00:1.5	1.00:1.8	1.00:1.6	1.00:1.6	1.00:1.3

(AM=Adult male, AF=Adult female, SAM=Sub adult male, SAF=Sub adult female)

#### 4.1.3. Distribution and Habitat association of Common warthog

The common warthog was distributed in to mixed grassland, woodland, and bush land. A total of 91 Warthog were recorded from three most important habitat types (Table 4). 43(47.25%) warthogs were observed from mixed grass land, 28(30.77%) were recorded from Bush land and 20 (21.98%) were observed in wood land. They were frequently observed in mixed grassland Secondly in the bush land. Which means highest number of common warthog was observed in mixed grass land but the lowest number were observed in wood land. There was statically significant deferent deference ( $\chi^2=8.99$ ,  $df = 2$ ,  $P < 0.05$ ) on the habitat types.

**Table4 Observation of Common warthog in different habitat types during study period.**

Habitat types	Animal observed
Mixed grass land	43
Bush land	28
Wood land	20
<b>Total/Average</b>	<b>91</b>

The animal survey in Diregudo revealed the density of common warthog was about 8.02/km<sup>2</sup> during wet and dry season. During study period the density of common warthog was 13.44/km<sup>2</sup> in mixed grass land, 6.1/ km<sup>2</sup> in bush land and 5.65/ km<sup>2</sup> in wood land.

## **4.2. Questionnaire**

### **4.2.1. Demographic status and attitude of the local people towards warthog.**

Mainly the age of respondents ranged from 18 to 65 years. Most of 248 (69.85%) of the respondents age ranges from 30-59 while 57 (16.05%), 29 (8.16%) were less than 30 and greater than 59 years respectively Less than 20 years was the least age range was 21 (5.91%). The age group 15 to 20 years has Positive feelings than age groups greater than 40. The majority of 209 (59 %) of > 59 age group had negative attitude towards the warthog. The negative attitude of respondents towards warthog was not statically significance ( $\chi^2=8.05$ ,  $df =5$ ,  $P >0.05$ ).

**Table 5 Age category and attitude of the local people towards warthog (N=355)**

Age category	N	Attitude towards the warthog		
		Positive (%)	Negative (%)	No idea%
15-20	21	66.54	26.32	7.14
20-29	57	63.08	29.93	6.99
30-39	83	61.66	31.03	7.31
40-49	102	60.41	33.19	6.4
50-59	63	52.82	38.81	8.37
>59	29	50.84	40.52	8.64
<b>Total/Average</b>	<b>355</b>	<b>59.22</b>	<b>33.3</b>	<b>7.48</b>

#### 4.2.2. Land holdings per household

Table 6 revealed that 15 (4.26%) of the interviewed respondents had land property less than 0.5hectare while 92 (25.89%) of the respondents had land holding of 0.5-1 hectare 140 (39.31%) of the respondents had the land property 1-2 hectare 80 (22.54%) of respondents had a land property of greater than 2 hectare. Land property greater than 2 hectare was statically significant ( $\chi^2=8.48$ ,  $df =2$ ,  $P<0.05$ ).

**Table 6 Land holding among villagers (N=355)**

Study area	<0.5ha%	0.5-1%	1-2ha%	>2ha%
<b>Dinsa</b>	5.71	37.14	42.85	14.28
<b>Dire gudo</b>	3.70	14.81	48.14	33.33
<b>Dobi</b>	5.72	25.71	48.57	20.00
<b>Total</b>	<b>15.13</b>	<b>77.66</b>	<b>139.56</b>	<b>67.61</b>

#### 4.2.3. Views of respondents on Warthog conservation

(Table7) indicate that 107 (30.14%) respondents showed positive attitude towards the important of warthog. However, 248 (69.86 %) had negative attitude towards the conservation of the animal. Table 7. Statically there was no significance deference ( $\chi^2=2.48$ ,  $df =2$ ,  $P>0.05$ ) among negative perception of respondents towards warthog conservation.

**Table 7 Attitude of respondents towards warthog conservation (N=355)**

Response category	Villages			Community perception		
	Dinsa	Diregudo	Dobi	Total	%	
Positive	39	27	41	107	30.14	-Tourism
Negative	89	71	88	248	69.86	-Crop riding  -Challenge for husbandry  -Difficulty for agricultural expansion
Total	128	98	129	355	100	

#### 4.2.4. Trends in Warthog population

Out of 355 respondents 186 (51.28%) of villagers around Diregudo forest on trends of Warthog populations in the forest recognized that the Warthog populations have declined in their particular areas. But, 143 (40.24%) of the respondents showed that the Warthog populations became increased. No more than 30 (8.47%) of the respondents had no idea about the trends of wildlife population (Table 8). The opinion of respondents on decreasing of warthog population was not statistically significant ( $\chi^2 = 1$ ,  $df = 2$ ,  $P > 0.05$ ).

**Table 8 Views of respondents on warthog population (N=355)**

study area	Increasing%	Decreasing%	No idea%
Dinsa	42.85	48.57	8.58
Dire gudo	40.75	48.14	11.11
Dobi	37.14	57.14	5.72
Total	120.74	153.85	25.41

#### 4.2.5. Warthog induced damage

The basic idea in the present study, crop riding by warthog has escalated because of a change in land use especially, the expansion and increasing of arable farming in and adjacent to the forest and the high growth in livestock population and settlement in the forest that resulted to conflict. Among the households, 59 (46.19%) of the respondents 28 (29%) of respondents respectively from Dinsa and Diregudo respectively experienced very little crop damage; again 38 (29.67%) and 25 (26.00%) of respondents respectively from Dinsa and Diregudo experienced much crop damage however 50 (39.09%) of respondents from Dobi showed no crop damage in their respective area. But the very little damage category was not statically significant ( $\chi^2 = 1.35$ ,  $df = 2$ ,  $P > 0.05$ ) on little damage. Table 9.

**Table 9 Warthog induced damage on crops (N=355)**

Damage category	Villages%		
	Dinsa	Dire gudo	Dobi
No damage	24.14	29	39.09
Very little	46.19	45.00	36.4
Much	29.67	26.00	24.51
Very much	0.00	0.00	0.00
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

#### 4.2.6. Distance from the forest and trend of crop damage

Many of 206 (57.95%) showed that the trend of crop damage became increased in their respective area. But 119 (33.58%) of the respondents showed that the trend of crop damage decreased in their area. Table 10. Average trends of crop damage by warthog was statically significant ( $\chi^2 = 36.73$ ,  $df = 2$ ,  $P < 0.05$ )

**Table 10. Approximate distance from the forest, trend of crop damage by Warthog (N=355)**

Distance from the forest(km)		Trends of crop damage (%)			
		Increased	Decreased	Unknown	
Study area	N				
<b>Dinsa</b>	128	0-2 km	68.57	22.85	8.58
<b>Dire gudo</b>	98	2-3km	48.14	40.75	11.11
<b>Dobi</b>	129	4-6km	57.14	37.14	5.72
<b>Total/Average</b>	<b>355</b>	<b>0-6km</b>	<b>57.95</b>	<b>33.58</b>	<b>8.47</b>

#### 4.2.7. Extent of Crop Loss

Table 11 indicates that not all crops were equally affected by warthog in all study sites. 156 (43.87%) of the respondents showed that maize was the most susceptible crop to the animal followed by wheat 124 (34.93%). Whereas about 75 (21.2%) the respondent showed that burley was the least vulnerable crop to damage caused by Warthog (Table 11). The view of respondents on preference of maize by warthog was not statically significance ( $\chi^2 = 3.34$ ,  $df = 2$ ,  $P > 0.05$ ).

**Table 11 View of the respondents on the types of crops preferred by warthog (N=355)**

Villages	Maize%	Wheat%	Burley%
Dinsa	50.0	35.7	14.3
Dire gudo	47.5	31.8	20.7
Dobi	34.1	37.3	28.6
<b>Total/ Average</b>	<b>43.86</b>	<b>34.93</b>	<b>21.2</b>

#### 4.2.8. Pest animals in terms of ranking

The villagers recognized that three wildlife species were responsible for the rank of crop damage (Table 12). Warthog ranked highest 160 (45.14%) among this followed by Bush pig 119 (33.43%). However olive baboon contributes only about 76 (21.43%) of the major problem. The rank of warthog as the highest pest animal was statically significant ( $\chi^2 = 95.47$ ,  $df = 2$ ,  $P < 0.05$ ).

**Table12. Pest animals in terms of ranking (N=355)**

Common name	Species	% of problem ranking		
		Major Problem	Minor Problem	No Problem
Common warthog	<i>Phacochoerus africanus</i>	79.0	15.7	5.3
Bush pig <i>larvatus</i>	<i>Potamoherus</i>	58.5	22.8	18.7
OliveBaboon	<i>(PapioAnubis)</i>	37.5	33.8	28.7
<b>Total/average</b>	<b>58.33 24.1</b>	<b>17.57</b>		

#### 4.2.9. Cultivated crop types and their preference by Warthog (pest)

Types of crops that the warthog around the forest usually prefer and cultivated by villagers were set in table 13. The pest animal usually prefers maize, wheat, and burley among the cultivated crops in the area. Furthermore, the common warthog damage crop both day and night time.

**Table 13 Commonly cultivated crop types and their preference by Warthog (N=355)**

Commonly cultivated crops	Warthog
Maize	*
Wheat	*
Burley	*
Teefee	-
<b>Time of damage</b>	<b>day/night</b>

Remember \* Preferred/consumed, - not preferred

**4.2.10. Protective measures adopted by farmers**

53 (41.1%) respondents from Dinsa, 46 (47.0%) respondents from Diregudo, and 52 (40.1%) from Dobi showed that guarding was the most and successful defensive way to reducing the damage of their crop from the animal. This showed that as the arable land close to the edge of protected area, it needs strong commitment to reduce crop destruction. The guarding way was not statically significant ( $\chi^2 = 0.65$  df =2,  $P > 0.05$ ).

**Table14 Methods of minimizing crop raid among different villages (N= 355)**

Villages N	Type of crop protection				
	Guarding	Alarming	Physical	Chemical	Stimuli
			barriers	repellents	
Dinsa	128	41.1	31.3	22.0	5.6
Diregudo	98	47.0	29.2	16.6	7.2
Dobi	129	40.1	33.7	19.6	6.6
<b>Total/Average</b>	<b>355</b>	<b>42.73</b>	<b>31.4</b>	<b>19.4</b>	<b>6.46</b>

**4.2.11. Educational level**

Literacy level and opinion of the local people are set in Table 15. The majority 194 (54.65 %) of respondents were illiterate 96 (27.04 %) of the respondents were read and write only 35 (9.86%) of respondents were at elementary level 30 (8.45 %) of the respondents were at high school level. 43.72% of illiterate respondents showed negative attitude towards protected area. 69.05% and 63.6 % high school and Elementary level had a positive attitude towards the reserve area. Comparatively high school and elementary level group had better perception on the conservation of the protected area. Averagely attitude of the respondents towards the forest was statically significant ( $\chi^2 = 40.16$ , df =2,  $P < 0.05$ ).

**Table 15 Educational level and attitude of the local people towards the forest (N=355)**

Educational level	N	Percentage	Attitude towards the forest		
			Positive (%)	Negative(%)	No idea%
Illiterate	194	54.65	43.72	50.1	6.18
Read and write only	96	27.04	60.53	31.64	7.83
Elementary	35	9.86	63.6	27.82	8.58
High school	30	8.45	69.05	23.64	7.31
<b>Total /average</b>	<b>355</b>	<b>100</b>	<b>59.22</b>	<b>33.3</b>	<b>7.48</b>

**4.2.12. Benefits from protected area**

Among respondents, 252 (71.08%) noted that they did not obtain any benefit from the existence of protected area. The probable benefits were property (fire wood, pasture and grass for house construction use, sale of fuel wood, and for agricultural equipment's). Only some of the respondents 103 (28.92%) showed that they have expected benefits from the protected area. However respondents did not obtain benefit from the existence of protected area was not statically significance ( $\chi^2 = 0.93$ ,  $df = 2$ ,  $P > 0.05$ ).

**Table 16 Views of respondents on benefits obtaining from protected area (N=355)**

Study area	yes%	No%
Dinsa	34.28	65.72
Dire gudo	29.62	70.38
Dobi	22.85	77.15
Total	86.75	213.25

#### 4.2.13. Human impact on the protected area

Anthropogenic factor largely make force on the forest by utilizing the resources for varies purposes. Among participants, many of 212 (59.68%) of respondents show that they utilize the protected area for grazing, 65 (18.22%) utilizes for tree or wood for different purposes and 31 (8.69%) for house construction and 44 (12.40%) of the respondents show that they utilize it for deferent purposes. There was no statically significant deference ( $\chi^2=0.18$ ,  $df =2$ ,  $P>0.05$ ) on grazing.

**Table 17 Use of resources from the forest by the local people (N=355 no. of households)**

Villages	N	Grazing (%)	House construction (%)	Trees/Wood (%)	Other benefits (%)
Dinsa	128	57.1	11.4	20	11.5
Diregudo	98	60.23	9.14	18.31	12.32
Dobi	129	61.71	8.57	16.35	13.37
<b>Total</b>	<b>355</b>	<b>59.68</b>	<b>9.7</b>	<b>18.22</b>	<b>12.39</b>

#### 4.2.14. Human Settlement

During the study period more than 57 huts were observed in and around the border of the forest showed. Out of 355 the respondents 215 (60.69%) support idea towards the construction of additional huts in and around the protected area. But 140 (39.31%) disagree to the construction of additional hut (Table 18). Opposing the settlement was not statically significant ( $\chi^2 = 0.07$ ,  $df =2$ ,  $P>0.05$ ).

**Table 18 Views of respondents to the construction of new huts in and around the forest (N=355)**

**Villages Support settlement%      Oppose settlement%**

Dinsa    59.48    40.52

Dire gudo        61.91    38.09

Dobi    61.15    39.65

**Total    60.69    39.42**

71 (61.91%) respondents from Diregudo and 79 (61.15%) respondents from Dobi support settlement, However 51 (40.52%) of respondents from Dinsa oppose the continuing construction of new hut.

Most respondents from Diregudo 78 (79.24%) and Dinsa 97 (76%) supported the construction of new huts. However, respondents from Diregudo 57 (58.18%) and Dobi 69 (53.23%) opposed construction of new huts in and around the forest.

#### 4.2.15. Habitat destruction and disturbance

The major components of habitat destruction and disturbance in the study area were settlement in and around the forest, overstocking livestock, frequent fire and bush encroachment, tree cutting for fuel, sale and construction of huts. Tree cutting was mainly associated with new settlement, which resulted deterioration of the remaining vegetation cover of the area. This minimizes the feeding ground, nesting and mating site of the wild animals. As a result, the vegetation structure has changed dramatically, grass cover has declined and the density of woody shrubs has increased alarmingly (Fig 11). There are deferent factors that aggravate the distraction of the forest in the area. Important economic activities in the area include the sale of trees, firewood and local brewing. Trees are cut and sold by men while firewood is transported to local markets by donkeys, mainly by women and girls from very poor households (IUCN, 2003).

#### 4.2.16. Focus group discussion

The discussions held with society (plate 1) indicate that communities in and around the forest had negative perception towards the presence of the forest. Only few participants support the presence and have positive attitude for the success for conservation of wildlife and their habitats. These few participants accepted the protected area and wildlife as the tourism potential. Although discussants do not get immediate benefits from the forest, some of the respondents recognized the presence of the protected area for the ecological benefit in the future.



Plate 1 Focus group discussions held with community around Diregudo forest (Photo by Barcha conservation cooperative)

Few of the participants express their idea previously that communities used to poison and kill different predators especially lions and leopards for their skin and in order to control livestock depredation from the area. The population of predators that may limit number of herbivores became decline. As a result population number of some herbivores like warthog and bush pig became increased to some extent in the area. Crop damage by pest animal is our significant problem.

The majority (58%) of participants have negative attitude towards the existence of the protected area. They think the forest as a limiting factor not to improve their livelihood. Participants recognize the protected area as limited access to resources, a means of income generating for government.

Grazing was a main concern of participants. The controlling of the protected area for grazing livestock was the cause for their traditional husbandry. Discussants recognized that they do get immediate benefit neither from the forest nor from the wildlife. However it is a limiting factor not to expand our agriculture.

Due to crop riding in the area most of the participants dissatisfied with the presence of protected area but they get limited access like fire wood, agricultural tools and grass despite they know it as illegal. They recognized those resources as their own asset, and they are not voluntary to stop using of those resources.

Additionally, discussants indicated the forest as it occupies the large area that may be used for agriculture and they suggest the protected area to restrict to the limited hectares of land and they want to use pasture, firewood without limitation.

Many (57%) of discussants give the priority for grazing land, fire wood but not the protection of common warthog. Some participants also indicated that few people were allowed to live inside the forest and others are forcefully dislocated from the same area that made them to have negative attitude towards the protected area. Some participants do not have awareness on the impact of the population growth. Few have indicated that shortage of agriculture land is consequence of population growth and suggested the government to have commitment on the issue of family planning. Discussants believed that many of the communities around the forest are small scale farmers that they depend on the forest for their livelihood and they suggest government intervention as a way to find a solution by building economic capacity of the communities. Discussants that have lack of awareness and poor relation with the conversationalists have negative attitude towards the protected area.

## IV. DISCUSSION

### 5.1. Population estimation of Common warthog

The present investigation revealed that the common warthog were widely distributed across all season and habitat types. The wide distribution of these species in most season and habitat types might be due to their behavior and access to resource. Young were born at the end of the dry season and at the early moment of the wet season as reported earlier elsewhere (Child *et al*, 1968, Boshe 1984). This is probably due to food and water to scarcity in the dry season. An increase in the human population and expansion of human settlements within and around the forest has aggravated the competition among the animals, livestock and people. However, this did not reveal any considerable impact on the warthog population in the study area.

#### 5.1.1. Sex Age Structure

The information of sex and age distribution of animal is vital for evaluating the viability of a species and the indicator of population change in the nearby future. Sex and age structure of a population at any particular occasion is also sign of the possibility of the population structure change (Wilson *et al*. 1996). The present study revealed that there were more females than males. The existence of more females and young expected to increase the population in the area. This shows the common warthog population was in intermediate condition in the study area.

In the present study, the sex and age ratio of male to female sex ratio (1.00:1.6) showed more female warthog than males. A comparatively high ratio of females in the population indicated that the common warthog have a potential to replace it and can tolerate the human disturbance. This shows healthy, increasing trend of warthog population in the study area as discovered earlier by Boshe (1981) in the Eastern Salous Game Reserve, Tanzania.

#### 5.1.2. Distribution and Habitat Association

During the present study, the common warthog occurs in all the three habitat types. The highest number of warthogs were recorded from mixed grassland and secondly from bush land habitats. Out of 91 recorded warthog, 43(47.25%) warthogs were observed from mixed grass land, 28(30.77%) were recorded from bush land. But, the lowest number was recorded from wood land. Although, warthogs do not prefer forests, they were found on the clearings between the forests (Lavrenchenko 2000). The same thing is true in the study area that 20 (21.98%) were recorded from wood land particularly from nearby water availability in the area. The highest population in a mixed grassland indicates that the anticipated of warthog to the grass land. The mixed grassland habitat has enough grass

cover may provide adequate food and reduce predation possibility. It inhibits in tropical, terrestrial, savanna or grass land and other habitat Features like agricultural land (African Wildlife Foundation, 2005).

Usually mixed grasslands are found near agricultural field. This possibly might have the chance to the availability of alternative food from the farm land. Additionally a variety of ecological factors like, breeding site and protection from predators might be important factors that determined the distribution of common warthog in the study area. Kinlaw, 1999 reported that soil and vegetation type also affects dispersal ability of the species. Additionally Estes 1991 reported that the common warthog are also extraordinary for an ungulate in that they sleep in burrows each night, and use burrows for protection against predators, for thermoregulation and for giving birth.

## **5.2. Questionnaire Survey**

### **5.2.1. Demographic status and attitude of the local people towards Warthog.**

During study period age category was recognized as one of the factor for the attitude of communities towards the warthog. The common negative attitude of the respondent's age group > 59 towards the warthog and positive attitude of age group 30-59 towards the animal indicate the young age groups have better perception awareness than older age groups towards the warthog.

The present study agreed with the findings of Tewdros Kumsa (2006) that the productivity of the land for the majority of farmers is less than sufficient and has no guaranteed source of income to supplement their livelihood. In the absence of alternative sources of income, the local people are more likely to resist rules and regulations, and continue to encroach the wildlife habitat.

### **5.2.2. Views of respondents on Warthog conservation**

Community perspectives towards the conservation area stem from a variety of contributing factors including loss of access to resources and benefits generated from conservation area, awareness concerning the importance of wildlife and crop distraction by wild animals (Kiss, 1990). The present study also showed that the people within and around the forest are small scale farmers who entirely depend on subsistence agriculture for their livelihoods. As result, some farmers around Diregudo complain that the wild mammals such as; warthog, bush pig etc are damaging their crops like wheat, maize, burly and other vegetable crops. Damaging crops by the Warthog resulted in the majority of respondents to perceive the animal as a harmful object on their livelihood was caused as a consequences of habitat disturbances. This result was in agreement with José line (2010) and Edward and Frank (2012) who reported increased habitat disturbance as caused of human wildlife conflict in Uganda. Jones (2012) reported that habitat destruction and fragmentation was the main cause of human primate conflict in Indonesia. Priston *et al.* (2012) reported anthropogenic habitat change cause crop raiding in southeast Sulawesi, Indonesia by primates.

### **5.2.3. Trends in Warthog population**

On the other hand the majority of respondents have no awareness on the objective of the protected area. Crop riding caused farmers to develop negative attitude towards wildlife conservation particularly those inhibited close to forest and pest animal faced frequent crop damage. This indicates that the conflict is particularly common in protected area buffer zones where healthy wildlife populations stray from protected area to in to adjacent cultivated fields. This is because of an increasing rate of cultivated area adjacent to protected areas (Clerici *et. al.*, 2005). Livestock depredation was not observed as a difficulty in the locality. These may possibly because of communities used to poison and kill different predators especially lions and leopards for their skin and in order to control livestock depredation from the area during unstable period in the country. As result the population of predators that might limit number of herbivores became decline. As a result population number of some herbivores like warthog and bush pig became increased to some extent in the area.

### **5.2.4. Conflict for resource**

#### **5.2.4.1. Warthog induced damage**

Some crops might be found palatable and attractive for wildlife, for instance according to Barnes (1996), among the plants adjacent to Kakum National park (Ghana) maize and cassava attract particularly elephants. The present study also confirmed the same situation in the study area, in which maize were highly preferred by most pest animal particularly warthog. The communities utilized deferent methods to protect their farm from damaged caused by pests. Guarding is common in the study area. In addition deterrents and poisoning was also observed in the study area. Antagonistic behavior of local people towards wildlife conservation and low level literacy aggravate the made the local people to have negative perception towards wildlife conservation. The present study indicated that education is considered as a first footstep in civilizing the communities' feelings towards conservation of wildlife and their habitat. It was found that the pattern of crop damage different between kebales. Dinsa and Diregudo reported more crop damage than Dobi. Communities complain bush pig and Anubis baboon for the loss in addition to warthog.

In addition, they relate their crop damage with the recent standing conservation activities of wildlife and habitat in their respective area. On the other hand, the core possible grounds for the crop damage may possibly be due to the increasing human population followed by agricultural expansion in and adjacent to protected area. The present study indicated that the rain fall, crop growing season are considered as important factors for extent of crop damage while the wildlife distribute widely from the reserve into the nearby public property, variability, characteristic of crops, food availability, distance from the forest are important factor for crop riding.

The villagers recognize that three species of wildlife species were responsible for the rank of crop damage (Table 16). Other reports also explained that worldwide primates and in East Africa Bush Pigs (*Potamochoerus larvatus*) were among the species most frequently cited by farmers as notorious crop raiders, capable of causing heavy crop damage; Warthogs (*Phacochoerus africanus*) are also highly involved (Sillero Zubiri and Switzer, 2001). The present study agreed with this initiative that warthog was the first crop rider followed by Bush pig. This shows the common warthog is the first crop rider in the area.

Distance from forest, nearest farm or village and farm protection methods will have an impact on crop raiding by wildlife (Hill, 1998; Naughton-Treves, 1998). The present study also revealed distance from the forest might be important factors for crop distraction. Additionally 72.44% of respondents from Dinsa (0-2km) reflect negative perception to the conservation area followed by Diregudo (2-3km) 69.53% of the respondents from Dire gudo reflects negative attitude on the case. This shows that wildlife and human became closer to each other crop riding bound to be increased. Crop riding caused farmers to develop negative attitude towards wildlife conservation particularly those inhibited close to forest and pest animal faced frequent crop damage. The community depends on agriculture and animal husbandry for their livelihood depends on land to create earning building that every one of the participants particularly closer to the reserve area build challenge to the animal. The raiding frequency and intensity influence the attitude of local people towards pests. Local peoples' perception of conflict does not always correspond to reality (Six and Struhsaker, 1999).

Not all crops were equally affected by Warthog in all study sites. 43.66% of the respondents showed that maize as the most susceptible crop to the animal. The pest animal usually prefers maize, wheat, and burley among the cultivated crops in the area. Furthermore, the common warthog damage crop both day and night time. Wheat is the second preferable crop next to maize while burly was considered as the last. This revealed that wheat is the second main susceptible crop next to maize. The result was agreed with finding of Warren (2008) who reported that Maize was the most frequently eaten crop by crop raiding in West Africa.

Deterrent techniques are temporary because animals soon learn and ignore the threat (Bauer, 2003). The effectiveness of methods to prevent damage by animals remains unclear. The behavior and preference of pests are quite different. However, for larger animals, guarding was the sole resort to prevent crop losses in the area. It is thus, recommended that a combination of techniques be employed in order to minimize the risk of wildlife becoming habituated to any single method. The same thing is true during the present study that guarding was considered as the most and successful defensive way to reducing the damage of their crops from the animal in the area. However the method wants strong commitment to reduce crop destruction that adults have recognized losing work and children's losing school while guarding.

Support for conservation was positively correlated with the level of education of the respondents. Gadd (2005) also observed a similar situation in a study of people's attitudes towards the wildlife in Kenya. The present study agreed with mentioned finding that literacy level was considered as one of factor that affects community perception on the existence of the animal and its habitat. The negative attitude more than 50% of illiterate respondents towards protected area and positive attitude of the high school & elementary educational level towards the reserve area revealed that the better educated groups had better perception on the conservation of the protected area. On the other hand the majority of respondents have no awareness on the objective of the protected area. Low level of understanding on the value of flora and fauna aggravate the situation more intense in the area. Understanding the value of wildlife was a common problem in all the studied villages.

#### **5.2.4.2. Benefits from protected area**

Some farmers around Diregudo reflect that they did not obtain any benefit from the existence of protected area. The recognized probable benefits were property (fuel, pasture and grass for house constriction use, sale of fuel wood, and for agricultural equipment's). This lack of getting benefit from the forest might lead the community to have negative attitude towards the forest and the animal. Finally, only some of the participants expressed a constructive approach to protection and shows the presence of the protected area have tourism and ecological value as a result they recommended that the protected area has to be protected from human interference. Tanzania similarly found that the attitudes of local people were influenced by the services and benefits that they received from the protected area (Newmark *et al.*, 1994). People will only seek to manage natural resources when they realize that the benefits exceed costs (Gadd, 2005).

### 5.2.4.3. Human and livestock impact

The main reason for habitat destruction and disturbance in the area was settlement in and around the forest resulting in deterioration of the remaining vegetation cover of the area. This reduces the feeding ground and reproductive place of the common warthog and other wildlife in the forest. As a result, the vegetation formation has deteriorated severely, and grass land has declined. In addition, bush encroachment has extended, modifying the flora and fauna in the area. As a result, the scale of grassland is being declined in spite of grazing pressures. Poor livelihood of local people, growth of human population, enormous livestock number, lack of awareness and considering the forest as their own asset resulted in a severe competition with the wildlife resources of the reserve area. The main cause of conservation challenge in the area was crop damage and the demand to expand their agriculture land exceedingly. Allowing of few individuals to live inside the forest and dislocating others forcefully from the same area made the community to have aggravated the case. The absence of dislocating individuals also makes people and livestock easily to wonder throughout the protected area and changed the habitat to agricultural land and settlement. Madden (2006) indicate that human wildlife conflict can be defined by a complex mix of characteristics which include instances of crop raiding, wildlife-livestock disease transmission, livestock depredation, destruction of property by wildlife and killing of wildlife by people. The same situation is observed in in the study area that the common warthog and other animal were observed close to livestock to utilizing the same resource that might expose the wildlife to the transmitted disease causing threat.

### 5.2.4.4. Human Encroachment and habitat disturbance

In many parts of Africa conflict between local people and wildlife is due to inhibiting the peoples adjacent to reserve areas. As a result protected areas are repeatedly under threat from growing human population in the continent (Newmark, *et. al.*, 1994). The same thing is true in the study area inhibiting the protected area. Diregudo is the forest that is protected from human activities. Because of this, it is used for the conservation and the protection of various fauna and flora. The large number of indigenous trees in the area serves a great amount in the ecological care. It is providing reliable habitat to Warthog and other animals. However, people always find various reasons to go frequently to the protected area. The present study shows that encroachment activities from the people have the greatest challenge to the survival of the warthog in the forest. The continuing construction of additional hut and human encroachment observed during study period may be the result of the above mentioned result in the study area. In addition to imposing pressure on the protected area, disturb the animal through abandoned fire. The present study also observed fire as a main threat to Warthog and other animal in the area. It was caused by farmers for agricultural expansion. The incidence of fire resulted in the decline of the quality of habitat and eliminated several indigenous species of vegetation that were not able to adapt. In the present study, the incidence of fire resulted in the decline of the quality of habitat and eliminates several endemic species of flora and fauna. In Diregudo forest, Fire was set by the local peoples for their agricultural expansion during the study period. This result was in agreement with José line (2010) and Edward and Frank (2012) who reported as increased habitat disturbance as caused of human wild life conflict in Uganda.

## 5.3. Focus group discussion

The discussions held with society indicate that communities in and around the forest have negative perception towards the presence of the animal and forest. Only few participants support the presence and have positive attitude for the success for conservation of warthog and other wildlife and their habitats. Discussants recognized that they do get immediate benefit neither from the forest nor from the animal. However it is a limiting factor not to expand our agriculture. The increasing negative effects of the animals from time to time resulted in frustration of some discussants with the existence of the animal and its habitat. The negative attitude of the community towards the animal and its habitat will challenge conservation activity in the future.

## V. CONCLUSION AND RECOMMENDATIONS

### 6.1. Conclusion

The present study provides valuable information on the current population size, habitat association of common warthog and their impact on agricultural crops in the study area. During the present study, the common warthog were widely distributed across all habitat types. An increase in the human population and expansion of human settlements within and around the forest has aggravated the competition among the animals, livestock and people. However, this did not reveal any considerable impact on the warthog population in the study area. Comparatively, healthy number of females and young in a population shows that if better care and conservation procedures are taken, the population number may possibly build up. On the other hand, if the existing problems in the area continue the population would further declined.

The largest number of warthogs were recorded from mixed grassland followed by secondly from bush land habitats. Crop riding is becoming more frequent and intense over recent years. As a result populations of some mammals become declined for the reason of habitat destruction. Rapid and extreme human population growth and activities such as deforestation, inappropriate site selection for investment in forested areas and expansion of agricultural activities together have led to increased human encroachment on previously wild and uninhabited areas. As a result the main problem of preserved area is associated with crop riding that formed local people to have negative attitude towards Warthog and their habitat. The causes of human warthog conflict in the area were habitat disturbance, agriculture expansion around forest edge, increased coffee plantation in the forest. The common warthog was the most commonly reported crop raiders. Bush Pig was the second problematic animals followed by Olive baboon on crop destruction in the study area. Maize was considered as the highest vulnerable crop to be damaged whereas wheat and burley was the second and third respectively. To bring sustainable wildlife management and rural community development at Diregudo, it requires reconciling the interest of stakeholders. These will be achieved only when their interest become balanced. To balance it, requires solving the conflict between the interest of the community and the conservationists.

## 6.2. Recommendations

- Literacy level was considered as an important factor for different perception. Due to this reason awareness need be created by government for local peoples (on conservation of Warthog, habitat and its diverse value).
- The animals are important, so that the local people should not harm the animals by offending their habitat.
- Continuous supervision and appraisal process of human Warthog conflict are needed for future conservation measures.
- Regular investigation should be carried out to distinguish alternative crops that do not be a focus for Warthog.
- Habitat destruction is the main reason for crop destruction. As a result it is better to encourage farmers as they keep the forest together and should cooperatively keep their crop farm from Warthog to minimize yield loss.

- Developing the way community became benefited from conservation in various ways that possibly build the tendency of community and the animal living in harmonized manner should be developed by government.
- The government should improve the living standards of the local people to change their way of life and reduce their reliance on the resources of the protected area.

APPENDIX

Appendix 1. Household questionnaire for local communities around Diregudo forest

1. Date-----
2. Name of respondent\_\_
3. Age \_\_\_\_\_Sex \_\_\_peasant association \_\_\_\_\_, family
4. Size\_no of wives \_\_\_\_occupation \_\_\_\_\_.
5. Educational status a. illiterate b. Read and write only c. Elementary d. High School.
6. Distance from the forest \_\_\_\_\_km. How long have you Lived? \_\_
7. What are your livelihood activities?  
a. Crop production b. Livestock keeping c. Farming and livestock keeping d. Trade e. other (mention)
8. Do you have livestock? If yes, type and number of livestock: a. Cattle b. sheep c. Goat d. donkey e. other
9. Do you have your own land? Yes/ No If yes how large it is? a. < 0.5 ha b. 0.5 - 1 ha c. 1 – 2 ha d. > 2 ha
10. Are you dependent on the forest for your livelihood activities? Yes/No If yes, how?
11. Do you know why the forest was formed?  
a. conservation b. tourism c don't know d. other
12. Do you think that the presence of the forest benefited the Community?
13. Yes/No If yes in what way?
14. Is there any resource that you have been prevented from the forest? Yes/No if yes, do you know the reason? If yes, mention and describe the reasons.
15. What do you feel on the population of warthog in the forest?

Animal type	Increased	Decreased	The same	Don't known
(common warthog)				

16. What type of wild animals do you know in your area?
17. What are the main crops grown by the people around this area?
18. Does warthog cause damage to your crops? Yes/ No
19. Can you sort these pictures into animals that are cause major damage, minor damage or no damage around this household, and explain why?

Animals	Damage

(Common warthog)	Major	Minor	No

21. Types of crop preferred by warthog.

Animal type (common warthog)	List of damaged crop(s) types

22. Time of damage. a) seedling b) vegetative c) Fruit

23. Maximum damage a) before hour b) after hour

24. How much is the extent of crop damage by warthog?

a. very little b. much c. very much

25. Which season is the problem more severe? Specify the months

26. What do the trends of crop damaged compared to the past 5 years looks like?

a. increase b. decrease c. stay the same

27. Methods of minimizing crop raid among different villages

Villages	N	Type of crop protection			
		Guarding	Alarming Stimuli	Physical barriers	Chemical repellents
Dinsa					
Diregudo					

Dobi					
<b>Total/Average</b>					

28. Do you believe warthog is a useful resource to be conserved? yes/ no
29. Do you want to involve yourself in managing the protected area? Yes/No If no, why?
30. For what purpose do you use the resource from the forest?  
 a. grazing b. Grazing c. House construction d. Trees/Wood e. Other benefits
31. Do you like the existence of the forest nearby you Yes/ No If no, why?
32. Do you think that Warthog and livestock can live together? Yes/ No, if yes, how?
33. Do you think the presence of people and livestock in the conservation area affects the forest? Yes/No If yes in what way
34. What is your opinion on the size of the forest?  
 a. Too big b. Two small c. right size
35. How do you prefer the area to be managed in the future?

**Appendix2. Focus group discussion**

Do you think the presence of the forest close to your area benefited the community? In what way and what benefits have been realized up until now?

Do you think that local people affect warthog?

How do local community and warthog (pest mammal) in the forest coexist in peace and harmoniously?

To increase the local community benefits and at the same time protecting warthog and other animal and their habitat, what should be done?

a. by the local community b. by conservationists

In order to bring sustainable development for both the forest and the local community, what do you suggest?

**Appendix3. Animal survey form**

Name of data collector----- Date----- Block number-----

Obs.No	AM	AF	SAM	SAF	Young	Total	Habitat type	Remark

							<b>ACKNOWLEDGMENT</b>	
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Key: - AM=Adult male AF= Adult female SAF= Sub-adult female SAM=Sub-adult male

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# Solar rack dryer with supplementary heat storage and evaluation of dried food quality

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**Abstract-** Performance of a solar rack dryer augmented with heat storage materials was evaluated in terms of temperature and humidity developments as well as quality characteristics of dried foods. Granite chips and granite rubbles were used as sensible heat storage materials. Also paraffin wax in aluminum trays and enclosed in PVC pipes were integrated into the collector as sensible and latent heat storage. Trials were carried out under natural and forced air draft conditions. Results showed that the solar rack dryer coupled with flat a plate collector containing granite rubbles, granite chips and paraffin wax collectively stabilized drying air temperature during the day time at 50°C, thus increasing the effective drying hours. However, marginally acceptable organoleptic quality of dehydrated foods indicated that the dryer further requires additional heat source to supply necessary heat during nights, and whenever necessary during daytime to obtain optimum product qualities.

**Index Terms-** Solar rack dryer, heat storage, effective solar drying hours

## I. INTRODUCTION

Inclined solar collector is one of the favorable design features of a solar rack dryer to harness solar energy [1,2]. A certain amount of energy savings could be possible in a solar rack dryer because of natural draft is made use to provide air flow through the insulated drying cabinet. It prevents direct solar radiation, thereby bleaching of products; however, it causes a lower temperature inside the drying chamber compared to that of a solar tunnel dryer due to no direct radiation to the drying chamber [4], which results in slow rates of drying. The rate of drying is mainly controlled by the rate of surface moisture evaporation and is highly influenced by the velocity and the humidity of the airflow. At the early stage of drying, since the trays are fully filled with the layers of products, airflow is obstructed to a certain extent.

The reduced rate of airflow gives rise to relatively high humidity build up in the air stream which results in low drying rates. As drying progresses, the food material shrinks creating more void spaces for free air flow resulting in reduced humidity in the drying air. Usually solar drying process cannot be completed in a single day due to the short time duration of solar radiation. Under these circumstances, when the half-dried food is left in the dryer overnight, moisture re-absorption occurs which extends the total period of drying. With these limitations, solar rack dryer usually takes three to five days for the completion of drying process. Further, leaving semi-dried

products in the dryer in the absence of drying air lead to spoilage, hence adversely affect the final product quality. This becomes crucial in the tropics due to the intermittent solar radiation and low radiation intensity during morning and evening times. To rectify this problem and to ensure continuous and effective drying, solar dryers require supplementary heat during night. One of the solutions would be to use direct solar energy as the major energy source during day time and supplementary heat by stored solar energy during night. The cheapest and easily available materials that can store energy from solar radiation in the form of sensible and latent heat are granite and paraffin [5] to maintain the drying temperature during night time and in the evening. Other option is to use paraffin wax. The melting point of paraffin wax is between 50°C and 60°C, and lies in the temperature range required for optimum drying of many crops. Paraffin wax shows slow rate of absorbance and release of heat due to its low thermal conductivity compared to granite. Similar studies aimed at increasing effective drying period in solar dryers have been reported for instance, the incorporation of basalt chippings into the collector for energy storage [6], and the use of rock bed collector cum storage, and augmented integrate rock bed storage air heater [7]. Similarly, heat required to prevent moisture re-absorption in the beans during the periods of non solar radiation has been adequately obtained by the integration of suitably black painted glazed gravels in development of an intermittent solar dryer [8] and reversed absorber with a packed bed thermal storage natural convection solar dryer [9]. A system that combines all heat storage materials with different thermal properties would enhance heat storage more than single a material used separately. Further, the presence of wax offers a more controlled rate of heat release.

Another possibility is to use a heat pump that provides high-grade energy from a low-temperature source through a condenser [10] which can be used if appropriately incorporated into a solar rack dryer during the operation. The ways of operating solar drying systems day and night are being constantly investigated which largely depends on the local conditions as well as availability of alternative sources of energy.

The objective of the present work was to investigate the possibility of integrating granite rubbles, granite chips and paraffin wax as heat storage materials into the solar rack dryer and thereby to improve the temperature development and stability with favorable relative humidity for continuous and accelerated drying.

## II. METHODOLOGY

### A. Modified rack dryer for heat storage

Several drying trials were carried out using a rack type solar dryer. The size of drying chamber was 0.8m x 0.7m x 1.6 m. The flat plate collector was made using black corrugated galvanized sheets as absorbance bed, with clear glass top. The size of the collector was 1.8m x 0.7m and the angle of inclination was 7° facing the south. In order to contain the heat storage materials, the solar rack dryer was modified by extending the collector area to have an extra area of approximately 1.3m<sup>2</sup> as shown in Figure 1. The temperature and humidity measurements were made by using EL008 Enviro Mon Data Logger equipped with EL 026 temperature humidity converters and EL030 temperature/humidity sensors. During the drying trials, the air velocity was measured using a turbo air-flow meter (range: 0- 44.8 ms<sup>-1</sup>, accuracy: ± 0.1ms<sup>-1</sup>). The moisture content of the samples was determined by the oven-dry method. All drying trials were carried out to test the performance of the prototype and modified system using 6mm thick circular pineapple slices (rings). The slices of pineapple were dipped in a solution of 30% °Brix sugar, 0.1% Sodium metabisulfite and 0.3% Citric acid for 10 minutes before placing in the dryer.

The first drying trail was carried out without any heat storage materials. In the second trial, the extra area of the collector was filled with an approximately 10cm thick layer of granite chips and 25cm thick layer of granite rubbles as shown in Figure 1. In the third trail, 5 aluminum trays and 4 PVC pipes of length 1m each filled with a total of 30kg paraffin wax were added to the bed of the granite rubbles as additional heat storage. For each trial, temperature, humidity and airflow rate were measured. The temperature and humidity sensors were located at the points as shown in Figure 1. The sensor at point 1 measured the ambient air conditions. Additionally, during trial 3, the moisture content of the samples was measured each day in the morning at the beginning of drying and in the afternoon (at 6.00pm) until the drying was completed. In the afternoon of the third day a sample was taken off the dryer and kept under room condition of 26-28°C and 70 -95% RH. In the morning of the fourth day, the moisture content of the sample kept in the room and a sample taken from the solar dryer were measured to compare the moisture re-adsorption during 12h period. A sample of pineapple was dehydrated using an electrical dryer to compare the products characteristics

### B. Water sorption and Organoleptic characters

Static gravimetric technique was used for the equilibrium moisture determination of dehydrated pineapple. Varieties of salt solutions were used according to their ability to develop temperature dependent equilibrium humidity values. The initial moisture content of the dehydrated pineapple sample was also determined. Five grams of dehydrated sample was placed in the cup made by aluminum foil (Figure 2) and glass jar was closed tightly. Airtight glass jars containing saturated salt solutions were placed in temperature-adjusted incubators for 15°C, 30°C, 40°C and 50°C to provide constant equilibrium humidity and constant temperatures. In order to prevent mould growth at high relative humidity levels small pieces of cotton

containing toluene were placed inside the sealed glass jars. Apparatus were allowed to equilibrate with the environment of temperature and humidity for 14 -21 days. The sample weights were determined at three day intervals until a constant or nearly constant weight was achieved using an analytical balance. Equilibrium moisture content was plotted against the relative humidity.

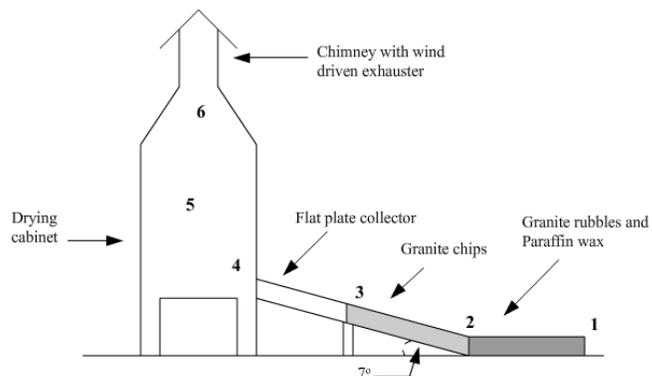


Figure 1 - Sensor location diagram of the solar rack dryer

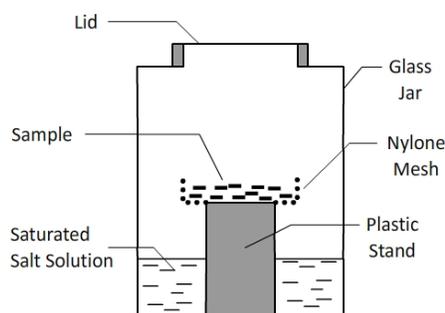


Figure 2 - Apparatus for equilibrium moisture content determination.

Organoleptic characters were evaluated based on color, odor, taste, texture and overall acceptability by a trained taste panel comprising of 10 persons. A nine point hedonic scale (1-2 = very poor, 3-4 = poor, 5-6 = fair, 7-8 = good, 9 = excellent) was used to evaluate each parameter. Results of the sensory tests were analyzed by Friedman Non Parametric method and Mann-Whitney Confidence Interval and Test. Statistical analysis was conducted using the applicative software SAS 6.12 and Minitab. Mean separation of sensory analysis was compared with LSD (Least Significance Difference) at  $p < 0.05$ .

## III. RESULTS

### A. Temperature developments in the dryer

The maximum and minimum values of solar radiation intensity of the trial date were reported as 3214 MJm<sup>-2</sup> and 19MJm<sup>-2</sup> respectively. The maximum and minimum temperatures of the trial days were recorded as 30.2°C and 25.1°C respectively. The average humidity during day time was 82% whereas that of night was 99%. Temperature variation in the drying cabinet and collector during the first

trial, with the flat plate collector without heat storage materials, are given in Figure 3. Results indicated that temperature development was below the required level of 50 – 60 °C range during the trial period from 10.00 am to 6.00 pm. Air velocity measured across the drying cabinet was in the range of 0.1 - 0.12ms<sup>-1</sup>. Results of the drying trial of pineapple showed that dryer was unable to reduce the moisture content of products below 20% for five days, thus resulting in poor product quality.

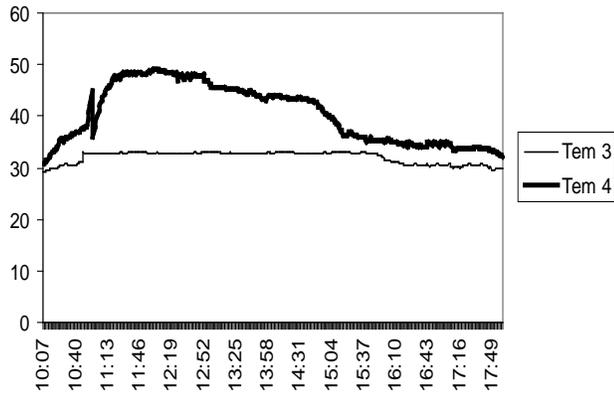


Figure 3 - Temperature variations at different locations with flat plate solar collector during no load trial period

According to the studies of Minaka (1986) no difference observed between open sun dryers and natural convection direct dryers as far as drying time is concerned due to low air movement across the dryer [11]. It has been reported that low airflow rate of natural convection dryers was the main reason for longer drying durations and their failures in practice [12] that was confirmed by the findings of the present study. In order to increase the airflow rate using forced air draft or using any other mechanism, adequate energy supply must be available.

The intention of using granite chips in this study was to investigate the possibility of providing a low-cost flat plate collector, with energy storage material for a short time period. The granite rubble stores heat and keeps it for a longer period as heat energy is released slowly. Further, laying of these two heat storage materials increased the collector area in trial 2 that gave encouraging results. As shown in Figures 4, the temperature of drying air was found to be greater than those of trial 1, that was carried out without heat storage materials. This naturally resulted in an increase in the effective drying period.

A significant reduction of temperature was observed, after 12.30 pm and prevailed till 6.00 pm, in the flat plate section. Temperature reduction rate was little slow till 3.40 pm and it followed the same pattern till 6.00 pm in the granite chips section of the flat plate collector. Rate of temperature reduction was slow in granite rubbles under the air velocity of 0.10 to 0.15 ms<sup>-1</sup> across the drying cabinet similar to the trial 1.

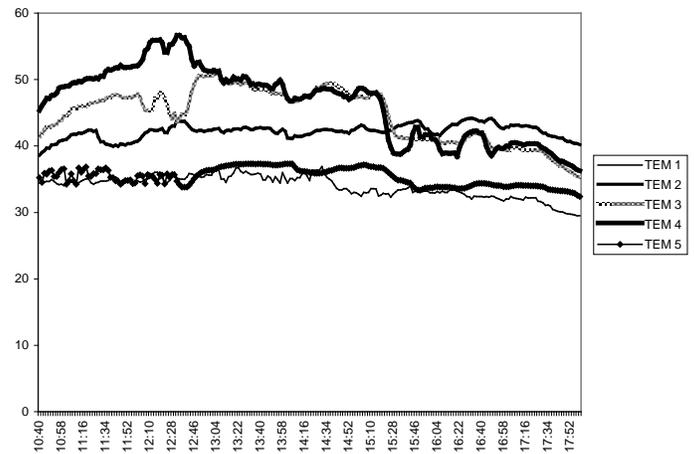


Figure 4 - Temperature variation at different locations when granite is used with flat plate solar collector during the drying trial.

The maximum and minimum of solar radiation intensity of the date of trial 3 were 1770MJm<sup>-2</sup> and 30MJm<sup>-2</sup> respectively. The maximum and minimum temperatures of the trial days were recorded as 30°C and 21°C, respectively. The average day time humidity was recorded as 79% whereas average night time humidity was 96%. The temperature built up in the drying chamber in trial 3 reached a peak in the range of 50°C – 55°C, after 1.30 p.m. as shown in Figure 5. Thereafter, this temperature level was maintained till afternoon.

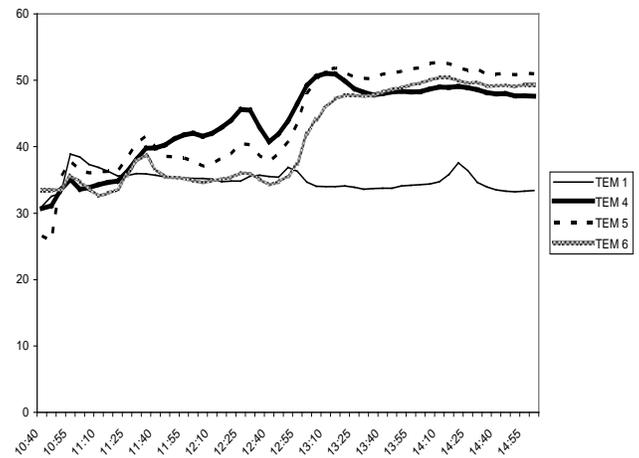


Figure 5 - Temperature variation at different locations when granite and paraffin wax is used with flat plate solar collector during the drying trial

A more stable temperature for optimum dehydration of fruits and vegetables was observed in this trial. This favorable performance was due to the incorporation of the additional heat storage material i.e. paraffin wax and the combined effect of flat plate collector with granite chips and granite rubbles. During the trials 1 and 2, a sunny weather prevailed and the dryer received relatively high amount of solar radiation throughout the day compared to the bad weather of the day of

trial 3. This resulted in a low temperature development in the drying chamber in the early hours and in the evening thus deviating from the full potential of using heat storage materials. During trial 3, it was possible to double the air flow rate using an air blower after 1.30pm from the starting range of 0.10 to 0.15 ms<sup>-1</sup>, to 0.25 to 0.30ms<sup>-1</sup> owing to the supply of more heat energy through increased collector area and due to additional heat storage materials than in trial 1 and 2. This increase in airflow rate did not cause a temperature drop that one would expect inside the drying chamber.

Use of wax as a heat storage material is an important area for new development. Some problems were encountered when wax came out of the end caps of the PVC pipes during melting due to expansion of volume. This difficulty of change in volume can be overcome by providing an additional space within ducts to allow for change in volume when wax melts. However, temperature development at location 4 (Figure 1) of the dryer during trial 2 (Figure 4) and trial 3 under given solar radiation, indicated that incorporation of wax to the collector in trial 3 has a significant effect to increase and stabilize the temperature at 50°C.

When wax is used as heat storage material it is possible to control the rate of heat release by suitably sizing the containers that enclose wax and by mixing wax with high conductivity materials to improve the rate of heat transfer. A similar study has indicated and reviewed by Garg (1987) in which micro encapsulation, metallic and powdered filler wire structures were used [5]. The findings of this research contribute to series of investigations conducted to develop a viable and low-cost dehydration system using solar dryers.

### B. Characteristics of dried products

Fruit like pineapple and other foods consist of water, carbohydrates, protein and fractions of lipids. These compounds are easily modified in longer drying durations, high temperatures, and high and very low humidity conditions. The moisture desorption and sorption results in degradation in sensory quality such as appearance, color, texture, flavor, shrinkages, and the product desirability for consumption is affected. Browning of pineapple can also occur by enzymatic and non-enzymatic reactions, which usually impairs the sensory properties of products due to associated changes in color, flavor, and texture, and the nutritional properties. During drying, significant changes in structural properties can be observed as water is removed from the moist material. Shrinkage occurs because food polymers cannot support their weight and, therefore, collapse under gravitational force in the absence of moisture. The collapse of structure and the resulting changes in porosity, including texture, during drying are key sensory properties perceived by consumers.

Soluble substances present in foods may undergo phase transformation. The occurrence of these phase changes depends on the presence of water. The physicochemical and microbial stability of foods under different temperatures and humidity during storage therefore can be predicted through moisture adsorption isotherms [13].

Moisture sorption studies of dehydrated pineapple at four different storage temperatures showed that sorption increased

with the increase of temperature (Figure 6). Thus the marked increment is shown at 50°C. The study shows that the curves are sigmoid in shape. In general, most of the food products show a decrease in EMC values with increasing temperatures at a constant water activity. The reasons for this phenomenon are the loss of hygroscopy at higher temperatures, increase in thermal motion of water molecules causing them to become less stable and break away from the water binding sites of the food, irreversible change in the substrate such as protein damage, and sugar caramelization. It has also been pointed out that the excitation of molecules and the distance and attraction between molecules are the reasons for adsorbed water to change with change in temperature at a given water activity [15, 16]. At higher temperatures and higher water activities increased hygroscopes are observed in pineapple which has less starch and protein content and more reducing and non reducing sugars such as sucrose, glucose and fructose. Crystalline sucrose contained foods adsorbs very little water until water activity reaches approximately 0.8 and the sucrose begins to dissolve when the drying is sufficiently rapid to produce amorphous sucrose as observed in the present study. This water uptake resulting in sorption levels was far higher than the initial level in pineapple, due to the greater internal area available for water sorption in the amorphous material and the greater ability of water to penetrate in to the H-bonded structure.

The stability of dehydrated pineapple decreases at very low humidity and high temperature as it can tolerate less water with the increase of temperature which leads to higher shrinkage, formation of hard texture and occurrence of browning reactions. Under high humidity and high temperature the stability of dehydrated pineapple decreases by way of softening due to the availability of more liquid water.

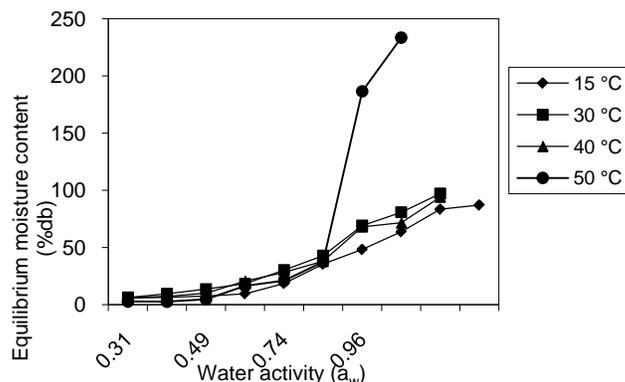


Figure 6-Moisture sorption isotherms of dehydrated pineapple at four different storage temperatures

Equilibrium moisture content of dehydrated pineapple corresponding to 75% and 96% relative humidity and under 15°C, 30°C, 40°C and 50°C are given in Table 2 and shows how large the sorption of water at increased relative humidity and increased temperatures. The equilibrium moisture content corresponding to a relative humidity of 75% is close to the average relative humidity value and ambient temperature in Sri Lanka. Results indicated that at ambient temperature (30 ± 2°C) dehydrated pineapple showed 21% EMC and which shifted to 71 % EMC under 96% relative humidity level. On

the other hand the relative amount of sorption of moisture could be observed under low temperature and high humidity development.

Table 2 - Equilibrium moisture content (%db) of pineapple, corresponding to 75% and 96% relative humidity

Relative humidity	Temperature °C			
	15	30	40	50
75%	18	21	28	30
96%	66	71	80	186

Laboratory tests under ideal conditions clearly indicated how moisture pick up happened under low temperature and saturated conditions as against high temperature and saturated conditions. Similar environment existed in the drying chamber of solar rack dryer under night time and daytime at low airflow rates. Therefore, measures should be taken to reduce high humidity development during the actual drying process (water desorption process) both at low temperature and high temperature in the solar rack dryer.

Results of the moisture measurements of pineapple slices are shown in Table 2. The sample that was kept under ambient conditions at the end of the third day reduced to 10.8% (wb) moisture content. The same sample showed 14.8% (wb) moisture content on the following morning, indicating a 4% moisture adsorption. The sample that was in the dryer having 10.8 % moisture content showed no significant change in the following morning. Thus no change of moisture content can be attributed to the presence of granite rubble, granite chips and paraffin wax which release heat energy to prevent moisture re-absorption in the night. This indicates that use of heat storage materials not only contributes to stabilize the optimum temperature during the daytime but also prevents nighttime moisture absorption when food was left in the dryer overnight.

Table2-Results of the moisture determination using solar rack dryer with granite rubbles, granite chips and paraffin wax as heat storage materials

Day	Time	Sample	Moisture Content (wb)
1	10 am	Inside the dryer	85.5 % ± 0.2
	6 pm		65.2 % ± 0.2
2	7 am	Inside the dryer	51.0% ± 0.2
	6 pm		60.2% ± 0.2
3	7 am	Inside the dryer	14.9% ± 0.2
	6 pm		10.8% ± 0.1
	6 pm	Room at ambient conditions	10.8% ± 0.1
4	7 am	Inside the dryer	9.2% ± 0.1
		Room at ambient conditions	14.8% ± 0.2

Permissible temperature, relative humidity and air velocity are three interrelated parameters, under which the dryer has to be operated for obtaining optimum quality. In most cases, drying

processes that use maximum temperature for short time do less damage to food than drying with lower temperatures for longer drying times. In most food products the drying process occurs in longer falling rate periods due to their structural and chemical composition. The prolonged period of drying coupled with the falling rate period could enhance the formation of unfavorable physicochemical changes in the food material. The rate of most browning reactions is greatly dependent on the combined effect of time, temperature and the intermediate moisture content of the food material. In solar rack dehydration (no direct solar radiation to the drying cabinet) product quality is greatly affected by the absence of optimum drying environment during the cloudy weather and in the nights.

Even though we were able to stabilize the temperature the effective drying period in trail 3 was extended and the extended drying period will have unfavorable effects on the organoleptic qualities. Therefore, we need to assess the dryer performance by analyzing product characteristics. In the dryer performance assessment we used pineapple rings of 6mm thick which is a relatively hard material thus being difficult to dehydrate. So it requires ideal drying environment for the completion of dehydration process. Sensory quality assessment of dehydrated pineapple obtained at 6 pm of the third day (Table 3) showed that sensory quality attribute of color is low due to browning reaction. Three days of prolonged drying environment of the solar rack dryer has been more favorable to accelerate these non- enzymatic and other browning reactions, that was indicated by poor color development and poor organoleptic quality attributes of appearance, taste and overall quality compared to those of electrical dryer.

Table 3- Sensory quality attributes of dehydrated pineapple

Sensory parameter	Sensory attributes (solar rack dryer)	Sensory attributes (electrical dryer)
Appearance	5.5 <sup>b</sup> ± 2.2	7.8 <sup>a</sup> ± 1.4
Color	5.2 <sup>b</sup> ± 1.3	7.4 <sup>a</sup> ± 1.2
Taste	6.1 <sup>b</sup> ± 1.0	7.2 <sup>a</sup> ± 1.3
Overall	5.4 <sup>b</sup> ± 1.5	7.7 <sup>a</sup> ± 1.5

Means followed by same superscript letters are not significantly different at 0.05% LSD

#### IV. CONCLUSIONS

Drying duration of solar rack dryer attached with flat plate collector is highly variable. Flat plate collector equipped with supplementary heat storage composed with granite chips, granite rubbles and paraffin wax stabilized the temperature at 50°C and increased the effective drying hours, thereby reducing the duration of drying in solar rack dryer. Moisture sorption analysis both at in vivo and in vitro indicated that the necessity of high air flow in the drying chamber of the solar rack dryer. The use of correct amounts of heat storage material and the location for the best temperature distribution needs further study.

Marginally acceptable organoleptic quality of dehydrated pineapple due to prolonged drying duration of the improved system indicated the dryer further requires an additional heat source to supply necessary heat during nights, and whenever

necessary during day time to reduce drying duration and optimize products qualities. In order to induce air flow and to have a better temperature control, a blower powered by solar PV panel could be used.

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# Innovation Practices of Manufacturing Firms' and Competitiveness: evidence from firms in Eastern Ethiopia

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**Abstract-** Innovation is generally regarded as a critical success factor in sustaining growth and competitiveness of firms in domestic and global markets. This study aims to investigate the innovation practices and identify factors that hinder innovation capability of Large and Medium Enterprises (LMEs) that are based in the eastern economic corridor of Ethiopia-Dire Dawa. Questionnaires were based on *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*. The data were analyzed using percentage, correlations and mean score; and presented in graph and table format. The results of this study indicate that technological innovation practices of LMEs are remarkably low. Cooperation aimed at using external knowledge with universities and research institutes are also weak. Collaborative research is almost null and their recent cooperation with universities is limited to trainings. Most LMEs don't have written innovation plans and don't place efforts in Research and Development (R and D) except in cement and chemical products producing firms. Firms' performance is triggered by their efforts in marketing and organizational; and regions' natural resource. It is also revealed a positive relationship between efforts in internal R and D and being exporter. The major barriers of technological innovation LMEs are: too high cost of innovation, lack of skilled personnel, lack of innovation culture and perceived economic risk; among others.

**Index Terms-** Innovations, Manufacturing Firms, Competitiveness, Dire Dawa-Ethiopia.

## I. INTRODUCTION

### 1.1. Background and Thesis Statement

In today's globalized business environment, world firms are facing fierce competition to sustain profitability in the market and meeting customers' needs. To respond effectively to the demanding global environment, firms need to develop a range of export capabilities by accessing new technologies, managerial practices, and technical and marketing skills and continuously upgrade them over time. The brunt of the competitiveness challenge manufacturing firms with no exception. The main challenge facing firms is how to take advantage of new resources and markets.

Entrepreneurship Innovation is generally regarded as a critical success factor to growth and competitiveness of firms on domestic and global markets. Hence, innovation decisions are the key strategy for every firm; and it is the most fundamental

instrument to enter to new market, to increase market shares and to increase competitiveness (Gunday et. al., 2011).

The early concept of innovation in economic development and entrepreneurship was popularized by Joseph Schumpeter, a German economist who is considered as the founding father of the theory of innovation in innovation literatures.

Innovation, in his view, comprises the elements of creativity, research and development (R&D), new processes, new products or services and advance in technologies (Lumpkin and Dess, 2001). According to Beaver (2002) innovation is regarded as an essential element for economic progress of a country and competitiveness of an industry. Similarly, Bakar and Ahmad (2010) add that the capability in product and business innovation is crucial for a firm to exploit new opportunities and to gain competitive advantage (as cited in Rosli M. and Sidek S., 2013).

Innovations would create competitive advantage in terms of resulting new or improved products, diversified product, low cost of producing outputs, producing quality products, new approach of delivering and marketing the product. Thereby, it enhances firm's productivity; firms export capacities and improve countries overall performance. Hence, innovation is an essential element for economic progress of a country and competitiveness of an industry. Thus, innovation is no more a luxury, but a necessity (Kaplan and Waren, 2007).

Innovation is never easy, but it is always possible. It could be simple or sophisticated. Innovation may start from small ideas; yet, it needs room and time to grow. Innovation activities in many cases may become sophisticated and require huge investment. Hence, firms can follow different strategies in innovation practice; that is, they may rely on own efforts or they may outsource.

To be competitive in local and global markets, firms in Ethiopia need to develop innovation capabilities that allow them to take advantage of market opportunities. This also needs strategies and coherent policies which should be based on scientific inquiry that investigates the innovation practice and innovation ecosystem where firms are operating.

According to the World Economic Forum's Global Competitiveness Index (GCI<sup>1</sup>), Ethiopia ranks 109 out of 140

<sup>1</sup>The current GCR consider factors such as macroeconomic stability, corruption (or the absence of it), security, education (both basic and advanced), the health of the labor force, regulation, financial development, then efficient use of talent, the right incentives for firms to invest in research and development (R&D), market size, the participation of women in the workforce, and the use of modern production and distribution techniques.

countries with a score of 3.7 out of 7.0 in the 2015-16 report whereas it was ranked 118 out of 144 countries in 2014-15 report [Global Competitiveness Report(GCR), 2016].In the Global Competitiveness Index framework, innovation is one of the pillars and in 2016 WEF an updating thinking was vivid and indicated that emphasis will be given to innovation, education and financial market which will be lead to updated version GCR in the coming edition of GCR (GCR, 2016).

Innovation research in developing countries and in Ethiopia is generally low and recent focus among researchers. So far, few researcheshave been conducted focusing on firms in AddisAbaba and others focus on selected survey at country level.

So far, no innovation research is conducted focusing particularly on country's eastern economic corridor and industrial zone-on manufacturing firms in Dire Dawa. This work; hence, focuses on assessing the innovation practice of firms in this economic zone of the country and comprising main aspect innovation as indicated in Oslo Manual, 2005.

Further, this research initiated and aimed at complementing the effort of Dire Dawa trade and industry bureau in transforming the existing manufacturing firms in the region to the export market and identifying specific problems of these manufacturing firms that hinder them to be competitive in foreign market. Thus, this research tries to assess the innovation practice of privately owned medium and large scale enterprises and to identify factors that hindering them to be innovative firm and competitive in the local and global market. Thus, the main research questions here include the following:

- ✗ Do firms made own innovation practice/efforts in Rand D?
- ✗ What are the focuses and patterns of innovation practice of manufacturing firms?
- ✗ What are the sources of firms' innovation practices?
- ✗ What factors are hindering firms from innovation activities?

## II. THE OBJECTIVE OF THE STUDY

### 2.1. General Objective

To assess the innovation practice and hindering factor that affect innovation and competitiveness of manufacturing firms in eastern Ethiopia.

### 2.2. Specific Objectives

The specific objectives include the following:

- i. To investigate manufacturing firms' innovation practices;
- ii. To explore the focuses and patterns of innovation activities of manufacturing firms;
- iii. To inspect the source of innovation practice in firms and;
- iv. To inspect the hindering factor in firm innovation and competitiveness.

### 2.3. Significance of the Study

The findings in this paper would be useful for firms in putting innovation strategies and entrepreneurial development of

firms, as well as to design and implement adequate industrial and innovation policies and designing innovation cooperation with other institution.

## III. CONCEPTUAL FRAMEWORK

### 3.1. Definition of Key Concepts

Based on Oslo Manual (2005), an **innovation** is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. The minimum requirement for an innovation is that the product, process, marketing method or organizational method must be new (or significantly improved) to the firm.

**Innovation activities** are all scientific, technological, organizational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations. Innovation activities also include R&D that is not directly related to the development of a specific innovation.

As the *Frascati Manual* states, R&D is only one step in the innovation process. Innovation involves a number of activities not included in R&D, such as later phases of development for preproduction, production and distribution, development activities with a lesser degree of novelty, support activities such as training and market preparation for product innovations, and development and implementation activities for new marketing methods or new organizational methods. In addition, many firms may have innovation activities that do not involve any R&D (Oslo manual #310, 2005).

### 3.2. Types of Innovation

The idea of innovation dates back to seminal works by Joseph Schumpeter. He distinguishes different basic types of innovation and defined innovation as encompassing the entire process, starting from a kernel of an idea continuing through all the steps to reach a marketable product that changes the economy.

According to Oslo manual (OECD/ Eurostat, 2005) innovation could be product innovation, process innovation, marketing innovation and organizational innovation.

First, a **product innovation** is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics (Oslo Manual #156, 2005).

Second, a **process innovation** is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software (Oslo Manual #163, 2005). This type of innovation is designed to decrease unit cost of production or delivery time, to improve product and delivery quality.

Third, a **marketing innovation** is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing (Oslo Manual #169, 2005). Of The target this type of innovation designed to better meet customers' need, to open up new markets, or to give the firm's products a new position in the market with the intention to increase sales income.

This innovation is highly related to the core business process of firms i.e., related to 4Ps these tools is generally referred to as 4P's of Marketing, product offers, pricing strategies, Promotion and Placement and promotion activities (Kotler P., 2002). Marketing innovation has direct effects on firm performance and it certainly facilitates the introduction and acceptance of radical new product innovation (Robert P. Cascio, 2011).

Lastly, an **organizational innovation** is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations (Oslo Manual #177, 2005). Such innovations have a tendency to increase the performance of firms by reducing administrative and transaction cost, improving work place satisfaction. They also include the introduction of training programs for developing the skill of employees or the initiation of supplier or customer development programs.

Firms that implemented at least one element of each type innovation during the period under review are considered as **innovative firm** of that specific innovation type (UNESCO: Institute for Statistics, 2015).

#### IV. RELATED INNOVATION RESEARCH IN ETHIOPIA

A few innovation researches have been undertaken in developing countries in general and particularly in Ethiopia. Gebreeyesus, M. (2009 and 2011) examines the factors that encourage and inhibit innovation among micro enterprises in Ethiopia's manufacturing, trade and services sectors. His result shows that larger firms and those in the manufacturing sector are more likely to engage in innovative activities.

On the other hand, Talegeta, S. (2014) analyses data from a sample of small and medium enterprises (SMEs) in Addis Ababa, and finds that there is a low level of technological innovation. He also identified the main obstacles to technological innovation for SMEs in Addis Ababa.

Another by Wakeford, J. et al. (2017) using a mixed method involving semi-structured interviews and survey questionnaires assesses the strengths and weaknesses of the emerging sectorial systems of innovation in three manufacturing sectors in Ethiopia – the cement, leather and textile sectors – with a view to establishing the extent to which they are geared toward supporting green innovation and hence green industrialization. Their results reveal that the extent of product and process innovation is generally rather low, and green innovation is even less common.

Again, by World Bank Group (2016) using World Bank Enterprise Survey on Ethiopia, found that which found that innovation is found to be positively associated with firm performance; and 68% of large firms, 49% of medium enterprises and 42% of small enterprises reported product or process innovation (extracted from their figure A, page 4). However, the country performs unfavorably vis-à-vis the selected comparators, as the share of firms that innovate in Ethiopia is about half of the share of the firms that do so in both China and Kenya.

Further, the World Bank research group (2016) analyzes the extent of innovative activities of firms in Ethiopia and identified that Ethiopia's innovation performance stifles its

overall competitiveness and the increase in government budget in the R&D was a result of the increased headcount of R&D personnel and not researchers. On the other hand, business sector spending on R&D has sharply declined contrary to higher education and government institutions.

#### V. OVERVIEW OF MANUFACTURING SECTOR IN ETHIOPIA

Modern manufacturing industries in Ethiopia emerged in 1920s (Gebreeyesus M., 2013). Currently, Ethiopia's long term development framework is underpinned by the second phase five year Growth and Transformation Plans (GTP II) which runs from 2015/16 to 2019/20. Building on GPTI and GTP II, Ethiopia plans to become a middle-income country by 2025 (African Development Bank, 2016). The GTP II targets annual GDP growth of 11% (driven by the manufacturing sector and rise in exports) and enable the country to reach its targets to middle income status (Ethiopia Economic Outlook, 2016).

Developing the manufacturing sector and enhancing export-led growth is the Ethiopia's government's policy of agriculture led-industrialization to sustain economic growth trajectory. The agriculture sector still remained a dominant sector, its share in GDP 36.7 percent in 2015/16 while the industry and services stood at 16.7 and 47.3 percent, respectively. While; the industrial sector showed a 20.6 percent annual growth and accounted for 16.7 percent of GDP and its contribution to GDP growth increased from 2.0 in 2010/11 to 3.1 in 2015/16 (National Bank Ethiopia, 2016).

The government under GTP II largely stresses the facilitation of structural transformation through developing a dynamic domestic industrial sector. It targeted to bring significant growth of the manufacturing industry; so that, it plays leading role in job creation, technology learning structural shift in Ethiopia's export and address trade imbalance (National Planning Commission, 2015).

The manufacturing sector is the key productive sectors of the economy. It has enormous potential for capital accumulation, employment generation and poverty alleviation. In 2015/16, the sector increased by 18.4 percent and constituted about 32.4 percent of industrial total production output (National Bank of Ethiopia, 2016). It accounts merely 6% of GDP; and it is dominated by food, beverage, textiles, hides & skins, and leather industries, and faces low growth rates. In order to combat this, the government has been building an Industrial Park Program. This initiative is aimed at boosting the manufacturing industry via foreign direct investments (Ethiopia Economic Outlook, 2016).

#### VI. OVERVIEW OF THE EASTERN INDUSTRIAL CORRIDOR: DIRE DAWA

Dire Dawa is located 515 km from Addis Ababa and 313 km from Port Djibouti. The latter is the main trade outlet for the country. Dire Dawa is the eastern economic corridor of Ethiopia it is one of the Industry zones of the country. So far, the industrial village has been established to meet satisfactory response for investor's request. Besides, the federal government is undergoing the construction of industrial park. According to Dire Dawa administration office; the administration has

working towards making Dire Dawa the commercial, industrial, and efficient service center of eastern Ethiopia. In line to this, the Dire Dawa trade and industry office also envisions transforming selected manufacturing and competitive in the export market.

## VII. METHODOLOGY AND DATA

### 7.1. Approach to Data Collection: Choice of the Survey Approach

According to 3<sup>rd</sup> edition Oslo Manual (2005) for innovation survey there are two main approaches to collecting data on innovations: The first is the “subject” approach starts from the innovative behavior and activities of the firm as a whole. The idea is to explore the factors influencing the innovative behavior of the firm. These surveys are designed to be representative of all industries so that the results can be grossed up and comparisons can be made between industries. Whereas the “object” approach involves the collection of data about specific innovations (usually a “significant innovation” of some kind or a firm’s main innovation). Hence, for this study the “subject approach” was found appropriate and applied for data collection.

### 7.2. Research Design and Analysis

Innovative activities can take place in small and medium-sized units as well as in large units. For this study primary data is collected from almost all medium scale enterprises (about 95%) and all large scale enterprises operating in Dire Dawa during the study period. Stratification was made in selecting firms in medium scale enterprises. And when relatively more number of industries found in the same category representative firms are included to represent that industry category. Accordingly, primary data were collected from LMEs in the food and beverage, mineral water, construction materials (cement), detergents, Metal crafts, and wood-based sub industries. Textiles and clothing firms are excluded since such firms have shut down their business and/or not operating for the study period. Therefore, from a total of 15 LMEs in the administration 10 MSE and 5 LSE are participated in the study. The assessment was carried out between March and April 2017.

### 7.3. Data Instruments and Data Analysis

The survey questions were based mainly on OECD/Eurostat’s (2005) *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*. Hence, a structured interview questionnaire was developed in line with a harmonized survey questionnaire based on community innovation survey 2012 and Oslo manual OECD, 2005. Questionnaires were pre-tested with managers who were not part of the sample before it is used in the field. Respondents were identified by name, address and telephone by Dire Dawa trade and industry office. Hence, it was easy to make appointment and administer interview questionnaires. The data were analyzed using percentage, correlations and mean score; to solicit relevant information about innovation practice, and presented in graph and table format.

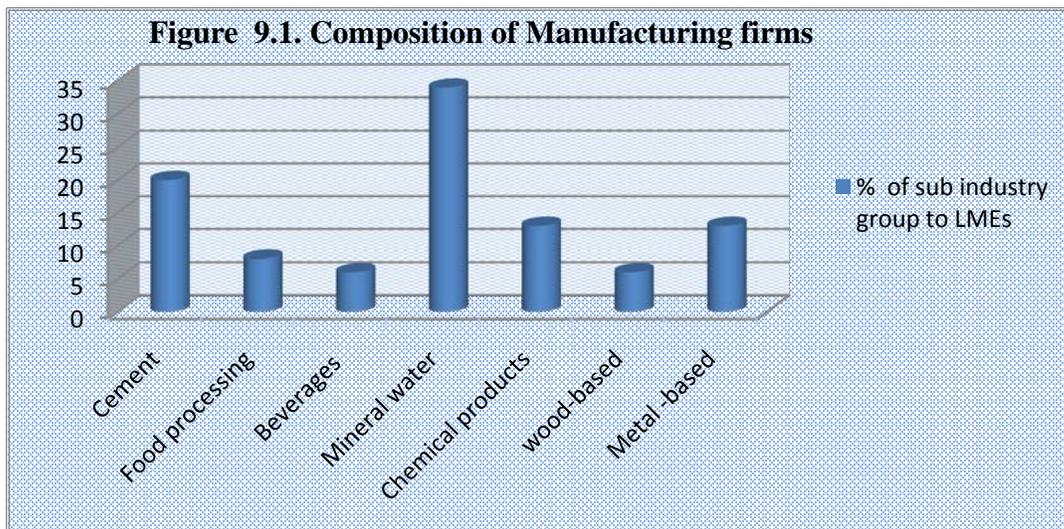
## VIII. MAIN FINDINGS

### 8.1. Composition of Manufacturing Firm

The classification of manufacturing enterprises, according to Ethiopian Central Statistical Agency (CSA) and Federal Micro and Small Enterprise Development Agency (FeMSEDA), the classification of enterprises into small, medium and large scale depends on a number of variables such as level of employment, turnover, capital investment, production capacity, level of technology and subsector.

Manufacturing Industries in Dire Dawa largely is largely dominated by small enterprises. Whereas, large and medium enterprises (LMEs) represent another segment and they are a building block of the manufacturing sector in the region. Out of 15 LMEs operating in Dire Dawa five of them are large enterprises operating in cement, food processing, chemical products (detergent and lubricants) and mineral water. The remaining is categorized under medium scale enterprises. LMEs are operating in cement, chemical products, food processing, metal based, wood based, beverages, and in mineral water.

The composition by sub-industry as seen from figure 9.1 below total LMEs that included in the study 34 percent operating in mineral water, 20 percent in cement, 13 in chemical products, 13 percent in metal based, 14 percent constitute firms in food and beverages and 6 percent are in wood-based. Textile industries were out of operation during the study period, hence excluded.



Source: Dire Dawa Trade and Industry(2017)

Respondents in this study were top management of firms and 93 percent are male and 7 percent are female. All respondents had tertiary education. With respect to legal registration of the business, a majority of the business was sole proprietorship and

private limited. Below in table 9.1 firms' imported input and export orientation are also indicated. Though most LMEs operation is using regions natural resource, they still depend on complementary imports.

Table 9.1: LMEs key Import and Export

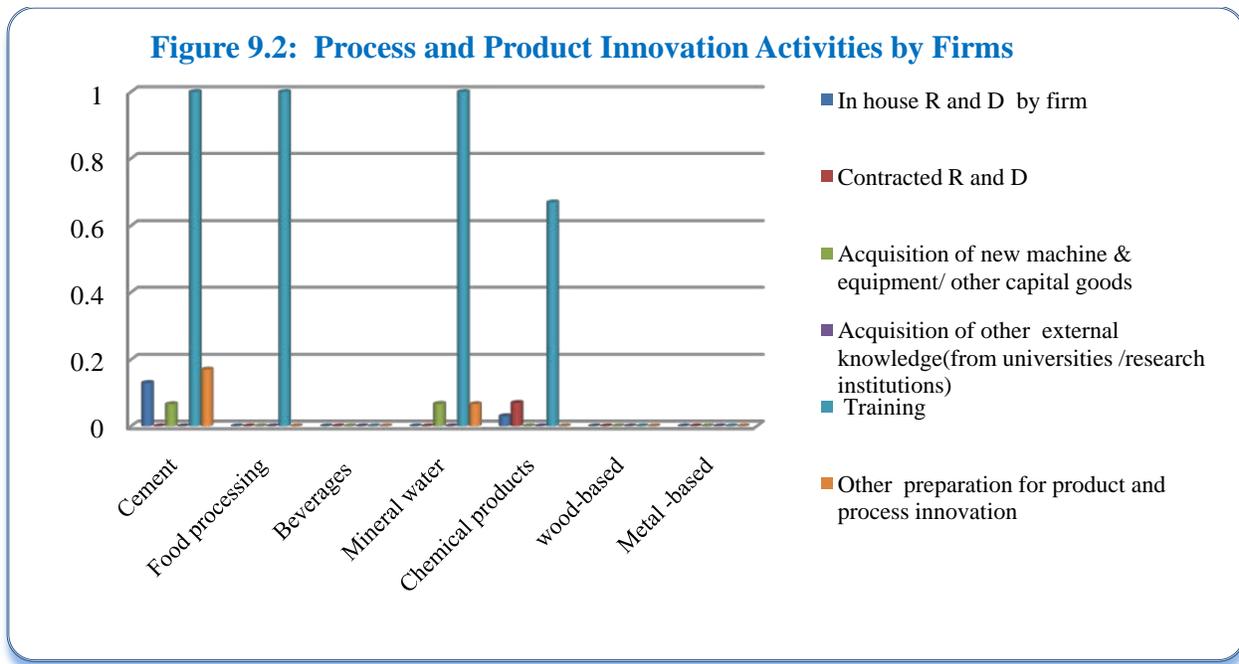
Industry Category	Imported Key inputs	Export of industry output	Export Market Destination
<b>Cement</b>	Energy(Coal)	Cement	Djibouti, Hargessa
<b>food Processing</b>	Wheat	-	
<b>Chemicals Processing</b>	Chemicals & Packing Materials	Detergents	Djibouti, Hargessa
<b>Mineral Water</b>	Plastic Bottles, Plastics, labeling materials	-	
<b>Beverages</b>	Packing Materials	Semi-Processed coffee	USA and Europe
<b>Wood based</b>	MDF, Chemicals	-	
<b>Metal based</b>	Metal	-	

Source: own survey results, 2017

### 8.2. Innovation Activities

**Innovation activities** are all scientific, technological, organizational, financial and commercial steps which actually lead, or are intended to lead, to the implementation of innovations. Some innovation activities are themselves innovative; others are not novel activities but are necessary for

the implementation of innovations. Innovation activities also include R&D that is not directly related to the development of a specific innovation (Oslo Manual#149). Providing innovation index for proper effort 1 to 0 for poor or non-existent effort, in each innovation categories as summarized in figure 9.2 below.



**Source: Based on sample survey (2017).**

Innovation in product and process is remarkably low and insignificant. It is limited up on firm start up and most remain in the status quo. In house R and D are only exist in cement and chemical and only in cement the accusation of improved equipment and machineries which improved product quality, cut production time and sustaining production.

Besides, as reported in almost all LMEs, firms do not have written down innovative plan. Most of firms don't have new products during the last two years. An attempt was reported in one of cement industry though not successful in the market. It is also reported in mineral water and chemical products producing firms they focus on marketing activities some of like metal and wood based on organizational and their attempt of innovation is inclined towards marketing and organizational innovation. Most of firms' production is based region's key natural resource and cheap labour force. In general, technological innovation (process and Product) are remarkably low among LMEs in Dire Dawa.

### 8.3 Innovation and Firm Performance

Perception of managers about performance of firms is mainly due to their effort in marketing and next on organizational change. Except for cement firms their sustainable performance is due to their newly acquired machinery that replaces manual efforts and that cut production time. It is also found that there is a positive correlation between investment on R & D and being an exporter firm. This association is for cement and chemical products.

### 8.4 Cooperation with Institutions

Cooperation is the active participation in joint innovation projects with other organizations. The partners need not derive immediate commercial benefit from the venture. Pure contracting out of work, where there is no active collaboration, is not regarded as cooperation (Oslo Manual #271).

Here, institutions are universities or other higher education institutions or public research institutes. The overall assessment indicates that, the cooperation and linkages with these institutions are remarkably low. It merely limited to training. Collaborative research is almost null. The sources of any attempt of innovation are manly from internal. Other countries knowledge limited to commissioning and training for the newly imported machinery which is made in fulfilling commercial commitments. Their business partners in such case are mainly South Africa, China, India, Malaysia and Singapore.

### 8.5 Hampering Factors

Policymakers and business leaders need accurate information on factors that support innovation, as well as on the obstacles that may hinder it, which may take many forms. In this study, the hampering factors for innovation activities have been divided into four categories: cost factors; knowledge factors; market factors; and others. These factors are similar to the factors indicated in Oslo Manual #410).Based on the degree of importance of the factors hampering innovation as rated by respondents (top management of LMES), the results are presented in table 9.3.The respondents' rate are scored and aggregated in summary for LMEs participated in this study.

**Table 9.3: The degree of importance of the factors hampering innovation**

Cost factors			Knowledge factor			Market factor		Others	
<b>Innovation costs are too high</b>	lack of funds within enterprise	Lack of appropriate source of finance	Lack of skilled personnel	Lack of information on technology	Lack of cooperation partner for innovation /Lack of innovation culture	Lack of customer responsiveness to new products	Lack of information on market	Perceived economic risk	lack of government policy and regulation
<b>High</b>	<b>Low</b>	<b>Low</b>	<b>High</b>	<b>Low</b>	<b>High</b>	<b>Low</b>	<b>Low</b>	<b>High</b>	<b>Low</b>

Source: Own summary from Questionnaires (2017)

Hence, based on respondents rate, the major barrier or hampering factor for most manufacturing firms or from factors hampering firms from innovation are too high Innovation cost, lack of qualified personnel, perceived economic risk, lack of cooperation partner for innovation or/ and lack of innovation culture are rated high, among other factors.

### 8.6. SWOT-Analysis

In innovation assessment, it is important to identify the issues affecting innovation in LMEs. The following SWOT analysis in table 9.2 is intended to provide information about firms' innovation ecosystem.

**Table 9.2: SWOT-Analysis**

Strengths	Weaknesses
Access to information technology and business run by Managers access to information about Market, competitors few identify innovation as one of organization's values	Some with short term vision and remain on the status quo and low process and product innovation. Most don't have innovation agenda, most depend on initial investment They focus on 'large' domestic market and Low export profile Focus on marketing and low attention to product improvement
Owner is truly interested in company not only a source of finance huge potential to be leveraged regarding employment Some LMEs opt for alternative energy source Produce products that are Import substitutes	Lack of competencies and contact networks High dependency on imported input Concentrate on similar manufacturing sector that uses region's natural resource Poor management in dealing with working force and high employee turnover
Some owner with competitive advantage from prior exposure	Most don't have special employee (department) for innovation and R & D
Awareness at some LMEs of the lack of and need for innovation Awareness for the importance of training for employee	Poor relationship with universities and research institutes; Poor linkage to external knowledge Non-existent personnel responsible for industry-institution(university)linkage
Awareness about supply chain and plan to integrate current business to expansion projects	Lack of initiation by managers in innovation practice Lack of knowledgeable consultants, low initiation of LMEs to co-funded R&D and innovation programs Focus only 'on the job trainings'.

Opportunities	Threats
Innovation policy and support for manufacturing sector(GTP II) Agency that support manufacturing sector	Globalization Technological Competition meeting quality standard
Clustering firms in industrial zone and construction of industrial park. Possible integration strategy with firms that appear in industrial park Common and improved facility and service will ease bureaucratic and increase efficiency	Lack of subsidy for innovation Non innovative SMEs tend to disappear soon Innovation requires more and more expensive technologies
Technology transfer foreign firms that appear in industrial park	Suspicion about employees readiness and fit to technology transfer
Anticipated market changes and competition will Push innovation Knowledge about Innovation as a resource for gaining competitiveadvantage	Competitive advantage obtained via innovation could be difficult to be sustained with internal Shortage of foreign exchange for key imports Technological and Managerial from insider- foreign firms resources
Firms are located near to port Djibouti Firms are located in region with international Airport and Railways and roads. Availability of natural resource that can be used as raw material for some industries	Environmental regulations standards for foreign firms may applies to them

Source: Own summary from Questionnaires (2017).

#### IX. CONCLUSION AND RECOMMENDATION

Product and process (technological innovation) practices of LMEs are remarkably low. The source of innovation practices is internal. Cooperation aimed at using external knowledge with universities and research institutes are also weak. Collaborative researches are almost null and their cooperation with universities is limited to trainings. Most LMEs don't have written innovation plans and don't put efforts in R and D except in cement and chemical products producing firms where there are some efforts. Firms' performance is triggered by some efforts in marketing and organizational changes, except in cement producers; and the uses of natural resources. It is found in those firms that, a positive relationship between efforts in internal R and D and being exporter firm in these firms. The major barriers of technological innovation LMEs are: too high cost of innovation, lack of skilled personnel, lack of innovation culture and perceived economic risk; among others.

Therefore, manufacturing firms need to promote process and product innovation if they are to remain competitive in local and global markets. Exclusively, to be an exporter, technological innovation in product and process is highly required. Firms should show their commitment to innovation by designing innovation strategy, establishing R and D department and allocate innovation budget. To complement this, the government should allocate subsidy for innovators. Moreover, to use external knowledge for innovation firms should design appropriate collaboration strategy and department in their structure.

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# Experimental analysis of cold compaction of aluminium alloy

Daravath srinu<sup>1</sup> Surarapu giribabu<sup>2</sup> Dharmapuri sreedhar<sup>3</sup>

## ABSTRACT

The aim of this work is to carry out the experimental analysis of cold compaction of aluminium alloy on universal testing machine with various pressure forces at room temperature. This is the process for recycling machining chips of aluminium alloy in to direct billets or ingots in a cylindrical form. In this method we can eliminate melting, casting and solidification process. The scope of this project is to carry out the work with the various process parameters such as temperature, chip size, material type and axial force, densities, relative densities etc. This process is suitable for consolidations and producing cylindrical billets / ingots at cold compaction and it is used in extrusion process for producing wire or rod. The objective of this work is to produce billets / ingots in a closed die and punch in the form of cylindrical in diameter, the billets are tested in metallurgical and mechanical point of view.

**Keywords :** Aluminium alloy,UTM machine,Die,Plunger,Specimen.

## 1. INTRODUCTION

Aluminum the most abundant crust element in earth after oxygen and silicon. Mostly the application of aluminum are commercialized in several sectors, such as an automotive, an aerospace and construction. An Aluminum material produced from two types technique either primary or secondary production. The primary production is a process from bauxite (ore)and the secondary production is a process to recycle aluminum waste. The recycling technique able to saving the cost of production. Almost 95% energy can be saved from recycling technique than primary technique. The secondary process involved a casting process technique. The reported problem is the higher material loses during casting process. From waste aluminum 54% become true product and 46% scrap and the most contribute affect during from a casting process. The relatively novel eco-friendly solution to minimize the processing cost issue is direct recycling process. It is an intelligence technique introduced by, to eliminate the casting process in secondary process. The hot extrusion or hot forging technique can be used to recover and eliminate the materials from sintering process in powder metallurgy. Normally the direct recycling process used aluminum waste in a compaction process and finally the billet is used as materials for hot extrusion or hot forging process. Almost in one year one billion kilograms waste from aluminum production placed in municipal solid waste. Recycled aluminum waste can be produced from machining processes. The aluminum wastes from machining operation also known as a chip. During the machining process almost 80% of heat were transferred to the chip surface. So the application of cutting fluid used in machining operation as a cooling medium to control heat during cutting process. There are several types of cutting fluid used in machining operations which are cutting oils, water-based fluids and gaseous fluid mixtures. Three techniques of lubricant conditions used in machining operation are dry, minimum quantity and flood. The different between techniques are the usage of lubricant quantity, which are maximum for flood condition, free for dry and minimum quantity is below than 50ml/h. Next the aluminum chips through the compaction process

## 2. LITERATURE SURVEY

As per the article published by 'Mr. Mohamad shyami shahrom', 'Ahmed Razlan Yousoff', Faculty of Manufacturing Engineering, University Malaysia Pahang,26600 Pekan, Pahang, Malaysia. Direct Recycling process of aluminum chips and scraps is a relatively novel eco-friendly solution to minimize the processing cost issue. To obtain highest qualities of product for direct recycling method, several factors need to be considered during processing. This paper presents the compaction effects of AA 6061 and AA7075 chips to densities, relative densities, consolidations and porosities, using different lubricants condition during machining process. The aluminum was machined by lathe machine with constant parameters of feed rate, spindle speed and depth of cut. Two types of lubricant conditions used in this machining process are dry and flood conditions. Afterwards, chips were cold compressed in a closed die, by punch and die with 30mm diameter. The final results shows that better density, relative density and porosity for flood machining conditions for both materials compared to dry machining condition. For the consolidated, it shows dry conditions better than flood conditions. The compaction of AA7075 is better than AA6061 chips in terms of density and porosity.

### 3. EXPERIMENTAL WORK

The entire experimental work is carried out with a series of sequential steps that includes design and fabrication of die and plunger, material selection for the experiment, composition of the material and finally process of work.

#### 3.1 DESIGN OF DIE AND PLUNGER

Design of die and plunger are made based on the design parameters like force, co-efficient of friction, extrusion rate, extrusion ratio etc., The amount of force that is varied during the experiment ranges from 230kN to 330kN on universal testing machine.

Force applied	230-330 Kn
Desired size of billet	21X30 (mm)

#### 3.2 DESIGN OF DIE :

force and size parameters. Hence the required size of the billet is 21mm long and 30mm in diameter the internal diameter of the die should be 30mm in diameter and the process is compaction we require a total length of at least 80mm of the die length to

obtain a billet of size 21mm in length and 30mm in diameter by impeding a variable force of 230kN to 330kN. Therefore the required size of the die is 80mm external diameter to withstand the compaction force and 80mm in length required for compaction. Size of the die is 80X80 (mm).

A plate is provided in the bottom of the die which is attached to the die with the help of screws. This plate is used to hold the die and also used for the purpose of extrusion. Hence the dimensions of the plate is assumed to be 80mm in diameter and 20mm in length. Therefore the total length of die including plate is assumed to be 80mm in diameter and 100mm in length. Total length of the die is taken as 100X80 (mm).

#### 3.3 DESIGN OF PLUNGER

Plunger is the object which is used as a compaction medium, through which the compaction done. Hence it should be strong enough to hold on its own and compact chips. The required billet length is around 21mm , hence the plunger should be long enough to cover the entire length of the die and should also have some clearance outside the die in order to carry out the extrusion process. Hence the length of the plunger should be around 120mm. The diameter of the plunger is taken as 29.75mm to have a clearance of 0.25mm for the purpose of free moment inside the die. The cylindrical length of plunger is 30mm long and is tapered to 28mm which holds as a fixed rod.

Therefore die and plunger is designed in AUTO CAD and the design is represented in the following figure

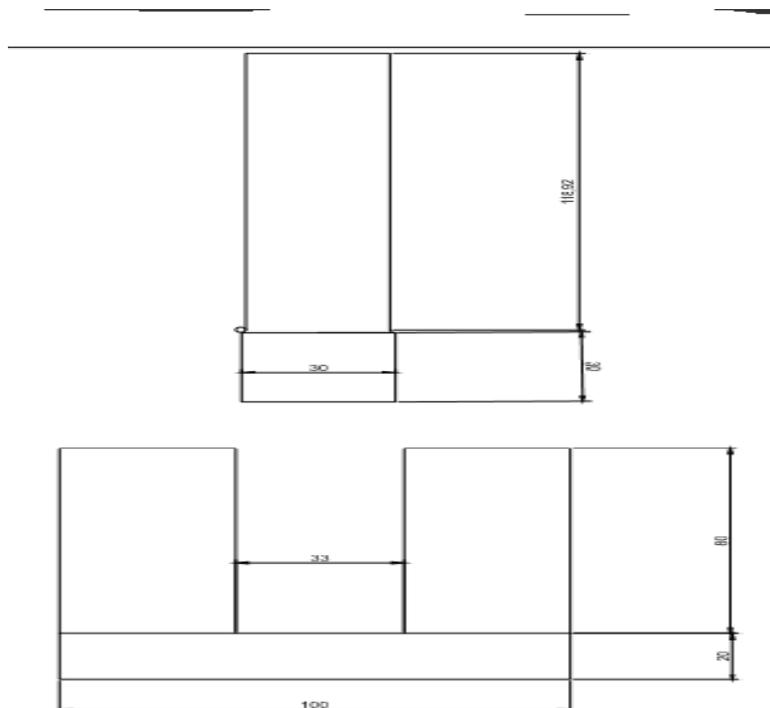


Fig 3.1: Design of die and plunger

### 3.4 MATERIAL OF DIE AND PLUNGER

**H13 Tool Steel** is a versatile chromium-molybdenum hot work steel that is widely used in hot work and cold work tooling applications. The hot hardness (hot strength) of H13 resists thermal fatigue cracking which occurs as a result of cyclic heating and cooling cycles in hot work tooling applications. Because of its excellent combination of high toughness and resistance to thermal fatigue cracking (also known as heat checking) H13 is used for more hot work tooling applications than any other tool steel. Because of its high toughness and very good stability in heat treatment, H13 is also used in a variety of cold work tooling applications. In these applications, H13 provides better harden ability (through hardening in large section thicknesses) and better wear resistance than common alloy steels such as 4140.

Also available as Electro-Slag-Remelted (ESR) and Vacuum-Arc-Re melted (VAR) products as well. The re melting processes provide improved chemical homogeneity, refinement of carbide size, and the associated improvements in mechanical properties and fatigue properties.

4. **COLD COMPACTION OF ALUMINIUM CHIPS:** Forming chips from aluminium 6061.



**Fig 4.1: Chips obtained after the machining of aluminium 6061 grade.**

- ❖ Dimensions of the chips are mentioned to be 0.5X1.5X5 (mm).

### 4.1 PROCESS OF WORK

The entire experimental work is carried out on universal testing machine which can apply load up to 400-600 kN. The chips obtained from processing the aluminum rod on lathe machine are filled into the hole provided in the die. The die is attached to the plate at the bottom with the help of the screws and tightened. This entire setup is placed on the base of Universal Testing Machine and is fixed tightly with the help of clamps provided on the base of UTM as shown is the figure below.

UTM machine with die fixed on the base with the help of clamps. After fixing the die to the clamps and filling the hole with chips up to the brim, then a plunger is placed on the top of the hole on to the chips and is fixed with the help of movable head of the UTM and then the load is applied with the help of operations provided as shown in the figure below.



**Fig 4.2: Die and plunger fixed in to the Universal Testing Machine.**

After completing the entire setup then the reading of displacement scale is noted and load is applied accordingly on to the plunger with the help of buttons provided in the machine which in turn applies the load on to the chips that is filled in the die . Initially the load is applied slowly and the then increased gradually achieving load up to 330kN as per the experimental work.

When the load is applied gradually the plunger move in the vertical downward direction compacting the chips present in the die. After applying the maximum desired load the chips are compacted up to 21mm from 80mm. The chips in the die are bonded together tightly with the help of cohesive forces between the molecules of aluminum and are bonded tightly due to cold welding which is called as cold compaction. Here the billet is formed inside the die , now in order to obtain the billet the plate under the die is removed and the billet is extruded from the die with the help of UTM as shown in the figure below. The obtained billet is of the size of 21mm in length and 30mm in diameter. This billet is the tested for the various properties like hardness, elongation, tensile strength ultimate, tensile strength yield etc.,



**Fig 4.3: Extruding the billet from the die with the help of UTM.**



**Fig 4.4: Variation of load on UTM.**

After these operations the billets are obtained at variable loads from 230 to 330 kN. The billets obtained are shown in the figure below.



Top view of the obtained billet.



Fig 4.5: Side view of the obtained billet.

The obtained billets are then tested for the mechanical properties and then compared with the original aluminium of grade 6061 and detailed analysis is tabulated in the form of result. The graphs obtained during the experiment is studied for variable loads from 230-330kN. The graphs are plotted between load and displacement. The graphs are as follows.

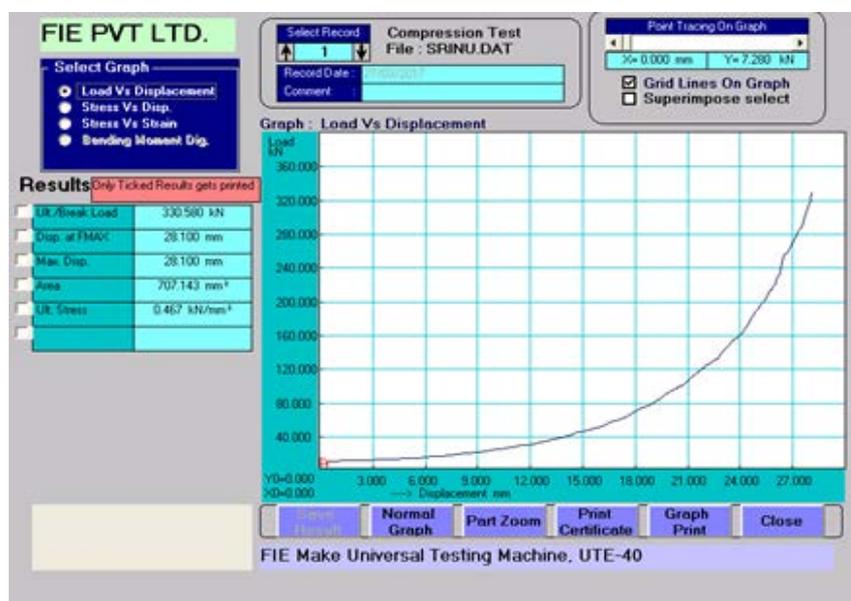


Fig 4.6: Load vs displacement for load of 330kN.

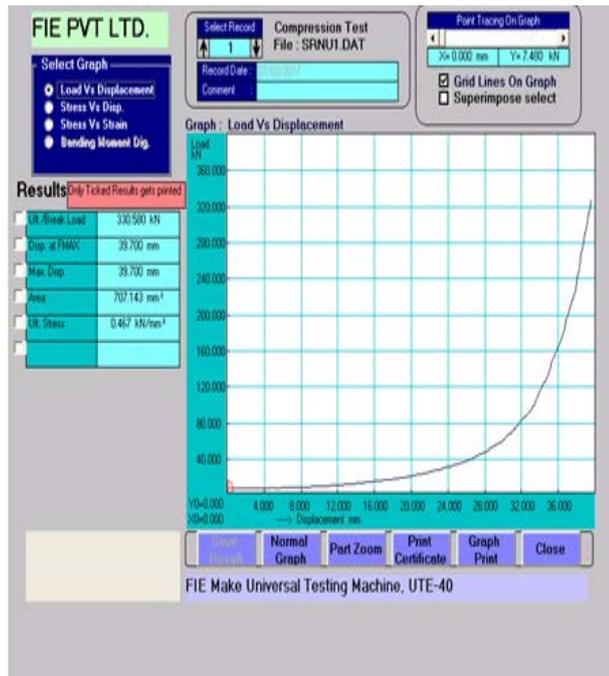


Fig 4.7: Load vs displacement curve for load of 320kN.

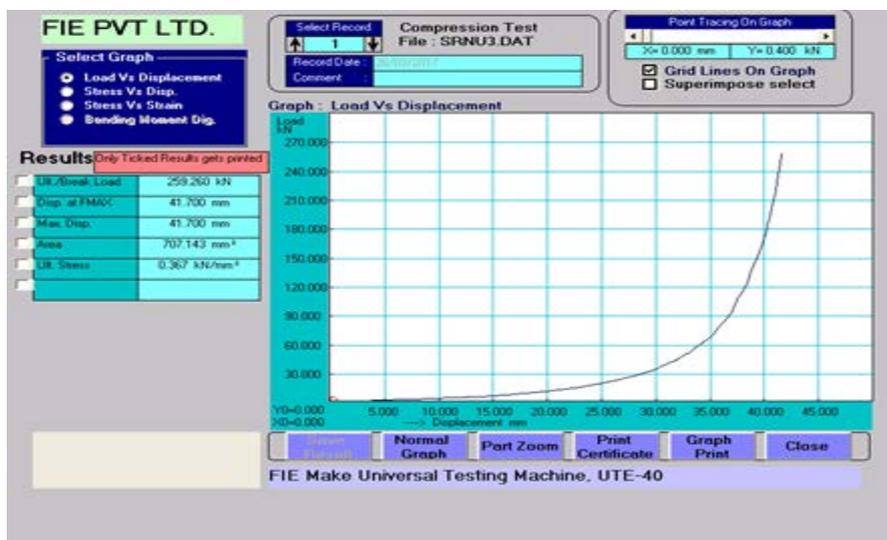


Fig 4.8: Load vs displacement curve for load of 260kN.

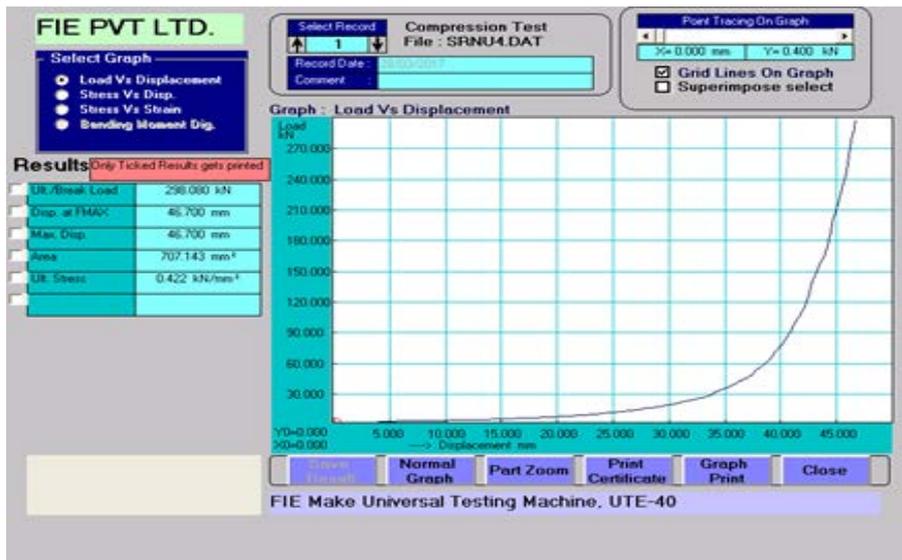


Fig 4.9: Load vs displacement curve for load of 298kN.

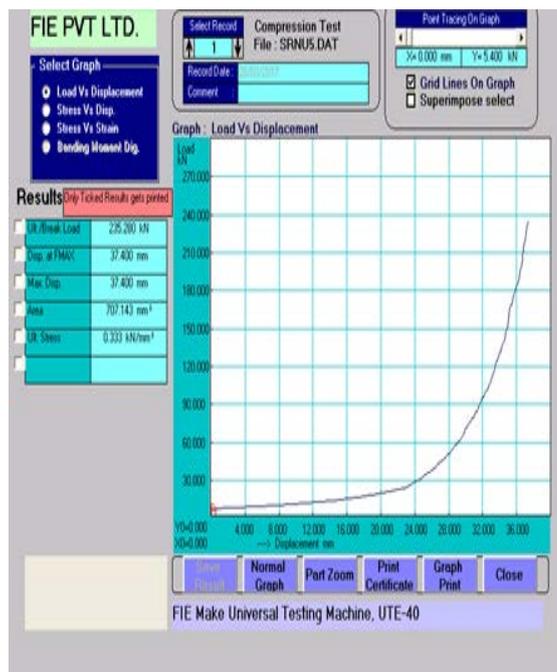
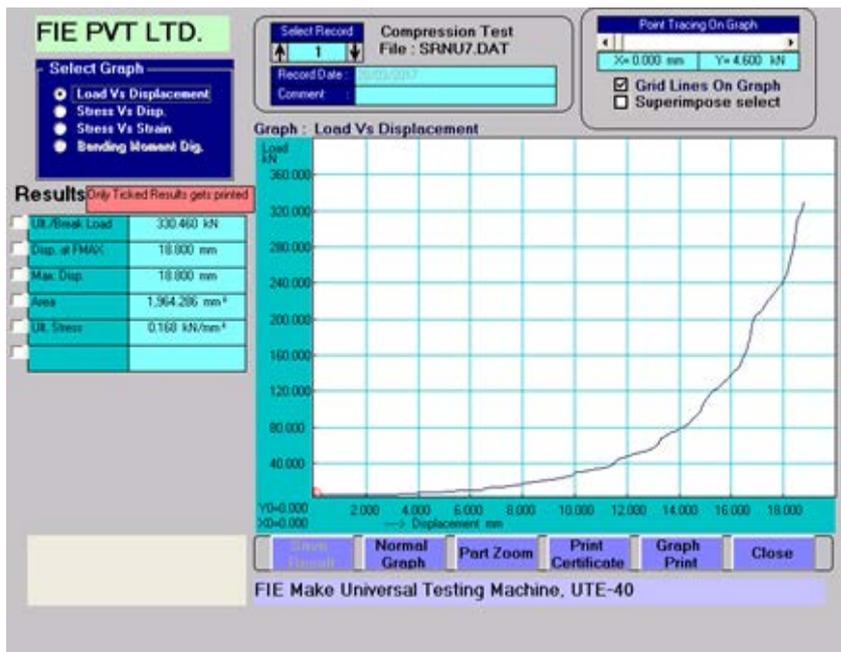


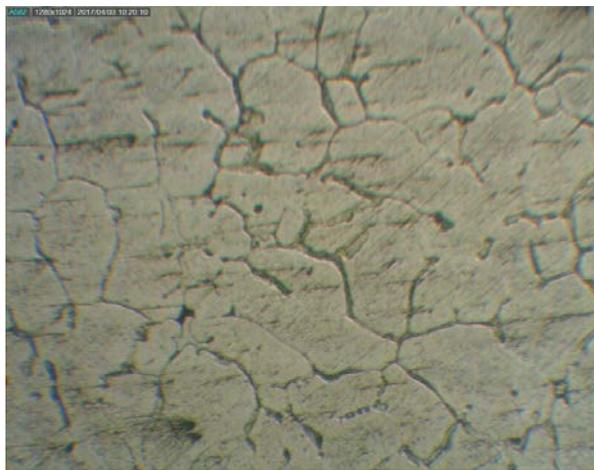
Fig 4.10: Load vs displacement curve for load of 230kN.



**Fig 4.11: Load vs displacement curve for load of 330kN with diameter of 50mm.**

### 5. RESULT AND DISCUSSION

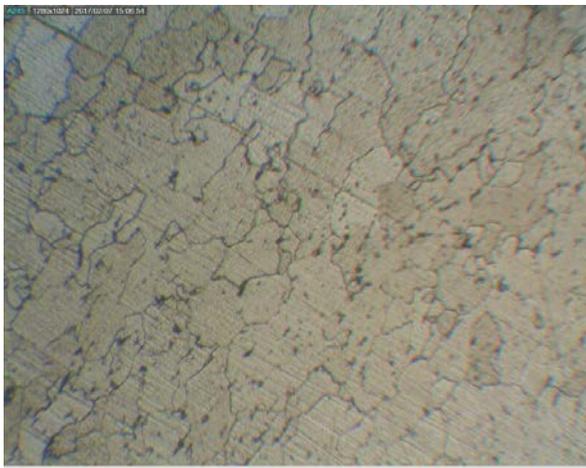
The above obtained billets are the sent to laboratory for testing the mechanical properties and microstructure. Then the properties of billets formed due to chips and the original aluminium 6061 grade rod are compared. The results obtained are as follows.



**Fig 5.1 Microstructure of billet-320kN.**

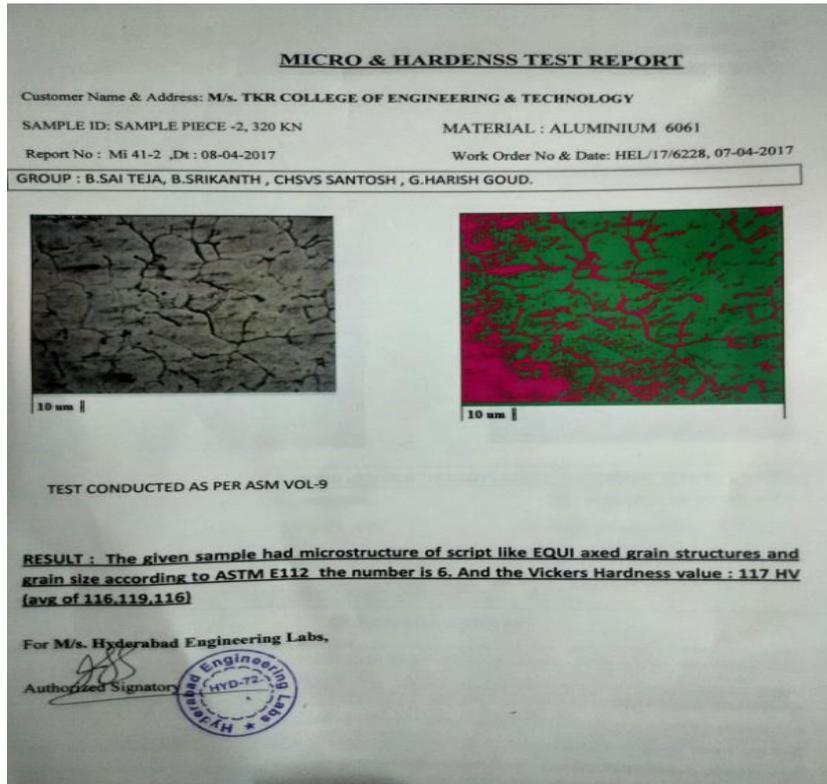


**Fig 5.2: Microstructure of billet-298kN**

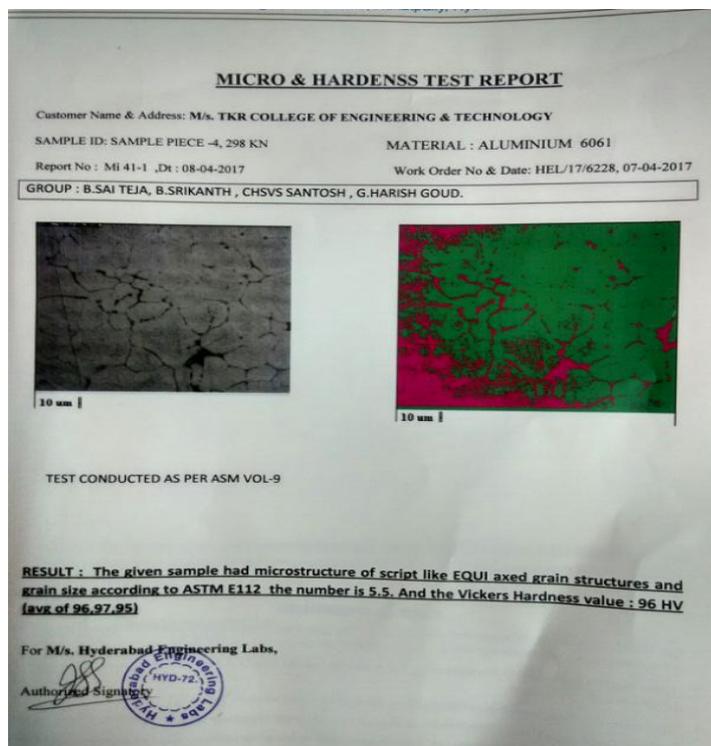


**Fig 5.3: Microstructure of original aluminium-6061 grade.**

### **5.1 MICRO STRUCTURE TEST REPORTS FOR BILLETS 320kN AND 298kN.**



Test report for billet-320kN.

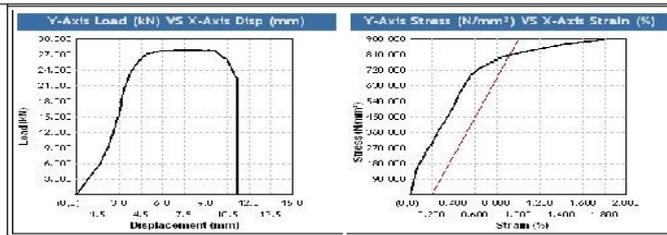


Test report for billet-298kN.

**TENSILE TEST REPORT FOR BILLET-320kN.**

HARDNESS VALUE: 107.

Input Data		Results		Specified Values
Specimen Type	: Round	Ultimate Tensile Strength	N/mm <sup>2</sup> : 310	
Initial Diameter	mm : 30	Elongation	% : 4.03	
Final Diameter	mm : 27	0.2% Proof Stress	N/mm <sup>2</sup> : 244.42	
C/S Area	mm <sup>2</sup> : 30.191			
Original Gauge Length	mm : 75			
Final Gauge Length	mm : 77.4			
Extensometer Gauge Length	mm : 25			

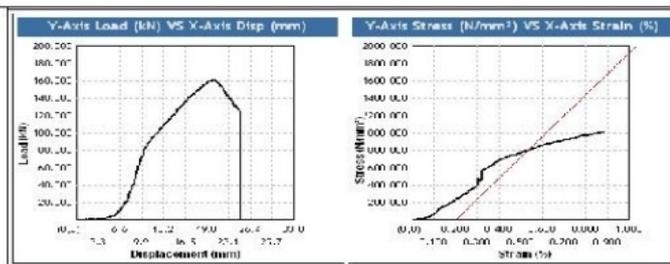


Report showing properties of billet-320kN.

**TENSILE TEST REPORT FOR ORIGINAL ALUMINIUM-6061.**

HARDNESS VALUE: 105.

Specimen Type	: Round	Ultimate Tensile Strength	N/mm <sup>2</sup> : 290.97
Initial Diameter	mm : 30	Elongation	% : 10.01
Final Diameter	mm : 28	0.2% Proof Stress	N/mm <sup>2</sup> : 220
C/S Area	mm <sup>2</sup> : 22.8		
Original Gauge Length	mm : 75		
Final Gauge Length	mm : 77.8		
Extensometer Gauge Length	mm : 25		



Remarks :

Report showing the properties of aluminium-6061.

**5.2 COMPARISION OF BILLET-320KN AND ALUMINIUM-6061.**

PROPERTIES	BILLET-320Kn	ALUMINIUM-6061
Hardness	107	105
Elongation	4.03%	10.01%
Ultimate Tensile Strength	310N/mm <sup>2</sup>	290.97N/mm <sup>2</sup>

## CONCLUSION

From the above obtained results we could conclude that the billets formed during the cold compaction process is due to cohesive forces between the molecules of same composition and due to cold welding between the chips.

- Here the billets formed for variable loads of 230-320kN are tested for hardness and found that as the applied load increases the hardness also increases.
- The hardness of the billets at 320kN is more than that of the hardness of aluminium-6061 provided with the test results.
- As the applied load increases, the displacement of the plunger increases and thus there by compaction increases and finally the hardness increases.
- The elongation of billet is less compared to aluminium-6061, because as the hardness increases the material loses its elastic nature and becomes more brittle and thus the elongation of the billet decreases to 4.3% while elongation of aluminium 6061 increases upto 10.01%.
- As the hardness of the billet is more than the hardness of the aluminium 6061, therefore the ultimate tensile strength of the billets is more (i.e. 310N/mm<sup>2</sup>) when compared to the ultimate tensile strength of aluminium 6061 (i.e. 290.97N/mm<sup>2</sup>).
- The dependence of the density on the amount of compacting pressure is influenced by the size and the geometry of the chips. It is therefore, not possible to specify a general optimal value for the compacting pressure (for all types of chips).
- At the same time, the size and the geometry of the chips has a significant influence on the consistency of the compact while it is being handled. Samples compacted from small chips under all considered pressure conditions (300, 400, 500, 600, 700MPa) were brittle.

Hence by following the above stated conclusions and statistics obtained from testing the billets obtained are ideal for the purpose of making wire by following the process of extrusion, while these wire can bear high stress up to 310N/mm<sup>2</sup>.

## FUTURE SCOPE

AA6061 is an important metal in the industry. Many of parts were fabricated by it in many applications. Chemical reactions should be investigated. The corrosion rate is so important to investigate. On the other hand, particle size and other parameters for compaction method are also important to investigate.

Though we conducted experiments on the process of cold compaction at various loads and the properties of the billets are studied accordingly and found out that the higher the load higher will be the hardness and tensile strength and lower will be elongation and hence the more brittle will be the material.

Although all chip types reached sufficient densities and integrity after cold compression, the quality of compactness still remains an issue. Therefore, future research would consider improving mechanical properties of the obtained specimens by imposing further severe deformations.

- There are three interesting areas of research to be investigated:
  - ❖ Modelling and simulating the entire process from powder filling, packing, pressing, ejecting to sintering in one numerical tool.
  - ❖ Cracking in details, Specially particle flow at corners.
  - ❖ High speed compaction.
  - ❖ All of these subjects can be investigated with the DEM-method.
- One drawback with the DEM-method is the geometry of the particles since they are all intact through the simulation as shown in . This drawback can be relaxed with a numerical method called material point method, MPM. This method discretize each particle into a number of material points and allows particle deformations during the simulation. One drawback with MPM is that it is very computer intensive

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# Determination of Actual soil erosion risk with change in land use/land cover in Isiukhu river catchment, Kakamega County, Kenya

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**Abstract-** Determination of soil erosion risk with change in land use/land cover is significantly important for its ecological, social and economic impacts. Soil erosion in study area depends on both environmental and anthropogenic factors. To measure such factors, revised universal soil loss equation (RUSLE) model in ArcGIS 10.3 has been employed in the study area. In this study, potential soil erosion risk (RUSLE<sub>potential</sub>) determined by environmental factors i.e. rainfall erosivity factor (R), soil erodibility factor (K) and slope length and slope steepness factor (LS) has been calculated. Land use/land cover factor (C) for 1990, 2000, 2010 and 2015 has been computed to measure its change with time. Soil erosion control factor (P) has been computed. Combining RUSLE<sub>potential</sub> with C factor and P factor resulted in actual soil erosion risk (RUSLE<sub>actual</sub>) for four different years.

The results showed that spatial distribution of potential soil erosion risk had a weighted mean (RUSLE<sub>weighted mean</sub>) of 63 t/ha/y with only 7.3% meeting soil erosion tolerance limit of 12 t ha<sup>-1</sup>y<sup>-1</sup>. The LULC changed with time, in 1990 weighted mean of C factor was 0.051 and in 2015 was 0.344. The actual soil erosion risk changed with time, in 1990 weighted mean (RUSLE<sub>weighted mean</sub>) was 7.2 t/ha/y and 85% of the catchment was within tolerance limit, and in 2015 weighted mean (RUSLE<sub>weighted mean</sub>) was 32 t/ha/y and 3% of the catchment was within tolerance limit. The study concludes that actual soil erosion risk in Isiukhu river catchment was influenced by change in Land use/land cover. The study discourages indiscriminate felling of trees, mono-cropping, over grazing, ploughing up and down the slope and other anthropogenic activities that expose ground surface for high surface run-off. The study recommends an all inclusive approach to environmental management that would encourage afforestation, proper land use/land cover and implementation of soil erosion control support practices to mitigate land degradation.

**Index Terms-** GIS, Isiukhu river catchment, Land use/land cover change, RUSLE, Actual soil erosion risk.

## I. INTRODUCTION

Globally soil erosion is one of the global environmental problems resulting in both on-site and off-site effects on catchments. Soil erosion, defined as the detachment,

transportation and deposition of soil particles by wind or water, is a natural process driven by physical factors [1]. The intensity of erosion processes depends on soil properties, topography and vegetation cover. The author in [2] stated that soil erosion leads to environmental degradation that is a precursor to disaster risks such as landslides, loss of soil fertility and infrastructure destruction. The economic implications of soil erosion are more serious in developing countries because of lack of capacity to cope with it and also to replace lost nutrients. These countries also have high population growth which leads to intensified use of already stressed resources and expansion of production to marginal and fragile lands. Such processes aggravate erosion and productivity declines, resulting in a population-poverty-land degradation cycle [3].

In Kenya, agriculture is the backbone of the country's economy. Good soils lead to increased agricultural production. Studies carried out on soil erosion risk in Kenya show that more than 75% of Kenya's soil is fragile environmentally. Soil erosion in Kenya leads to land degradation that lowers its capability to produce and increases its vulnerability to disaster hazards [4]. Farmers' knowledge on soil erosion hazards is very crucial in sustaining Kenya's agricultural production [5]. The anthropogenic pressure on land in Kenya is essentially reflected in the land cover, where land use change and -intensity and cultivation practices, such as tillage and implementation of conservation strategies, determine the vulnerability to erosion [6].

Isiukhu River has its source in Nandi escarpment, Nandi forest on the boundary of Nandi and Kakamega Counties. It combines with river Lusumu before draining in river Nzoia in Mumias Sub-County. Isiukhu river catchment has had a lot of environmental challenges emanating from deforestation and improper conservation measures [7]. Mono-cropping of maize and sugarcane on majority of the farms in the catchment poses serious environmental challenges including landslides that occurred at Khuvasali village in August 2007 killing 12 people, injuring 100 and displacing 49 families and another one at Chepng'abai hills in May 2016 that killed one mother and her four children [7, 8]. Technologies to counteract fertility constraints are rarely implemented, as they do not consider system diversity or farm-specific characteristics [9].

Soil erosion in study area depends on both environmental and anthropogenic factors. To measure such factors, revised universal

soil loss equation (RUSLE) model in ArcGIS 10.3 has been employed in the study area. According to the author in [10], the process for determining soil erosion must involve identifying the factors that control the risk of erosion, use parameters for which data are available for the particular region, can be adjusted easily as more/better information becomes available, and is a method that has been vetted in the published literature. A number of models have been developed to predict soil erosion risk at various scales from individual fields to entire drainage basins. Each model requires specific information in order to predict soil erosion risk. This information is not available for Isiukhu river catchment.

It is with the foregoing in mind that this research sought to fulfill its objective of determining soil erosion risk with change in land use/land cover in Isiukhu river catchment. The study employed RUSLE model in ArcGIS 10.3 in determining soil erosion risk.

## II. STUDY DETAILS, MATERIALANDMETHODS

### Study site

Isiukhu river catchment lies in Kakamega County, Western region of Kenya Its geographical coordinates are: 0° 15' 0" – 0° 25' 0" North and 34° 40' 0" - 34° 55' 0" East(Figure 1). The study area covers an area of approximately 683.0 Km<sup>2</sup> (68,300ha) with an approximate population of 373,600. The altitudes of the study area range from 1,317 metres above sea level to 2,144 metres above sea level. There are two main ecological zones in the catchment namely; the Upper Medium (UM) and the Lower Medium (LM). The Upper Medium in which Nandi escarpment lies covers the Central and Northern parts of the county such as Lurambi, Malava, Shinyalu and Ikolomani that practise intensive maize, beans and horticultural production mainly on small scale; and Lugari and Likuyani where large scale farming is practiced. The second ecological zone, the Lower Medium (LM), covers a major portion of the southern part of the county which includes Mumias, Matungu and Butere and Khwisero. In this zone, the main economic activity is sugarcane and maize production with some farmers practicing sweet potatoes, tea, ground nuts and cassava production.

### Data collection and processing

Meteorological data—monthly and annual precipitation data from available rainfall stations serving Isiukhu river catchment – Malava forest, Mundoli, Kakamega Met. Station, Mumias sugar, Bukura ATC and Alupe KALRO. Soil and Terrain (SOTER) map - vector data set from international soil reference and information centre (ISRIC) world soil information for Kenya soil DataBase set (KENSOTER). Digital Elevation Model (DEM) of 30m resolution—reference data set from Kakamega County Survey Office, based on the photogrammetric workout in the form of a Triangulated Irregular Network (TIN) having a vertical accuracy to the tens of centimeters.

### Computation of Rainfall Erosivity Factor (R)

The rainfall erosivity factor (R) was calculated from equation (1) [11].

$$F_M = \sum_{i=1}^{12} \frac{P_i^2}{P} \quad (1)$$

where:  $F_M$  = Modified Fournier Index,  $P_i$  = the monthly average amount of precipitation for month i (mm), and  $P$  = the average annual quantity of precipitation (mm).

Plotting  $F_M$  index values in mm (Y - axis) against rainfall station altitudes in metres (X – axis) generated equation (2) which was used in ArcGIS 10.3 to compute rainfall erosivity factor (R) map.

$$Y = -0.0144X + 194.29 \quad (2)$$

where: Y = Modified Fournier Index in mm, X = Study area DEM

### Computation of soil erodibility factor (K)

For this study, K factor was generated from the soil shapefile map of the Isiukhu study area. Kenya soil database was used to produce the soil shapefile for the study area. The soil map was overlaid in ArcGIS. It was given spatial reference which was the same as the study area (WGS 1984 UTM Zone 37N). The study area was then clipped from the rest of the soil map feature and attribute table of the study area was edited for K factor before it was changed to raster file to give K factor map and its values.

### Computation of slope length and slope steepness factor (LS)

LS factor was calculated from equation (3) [12]

$$LS = \left( \frac{x}{22.13} \right)^m (0.065 + 0.045s + 0.065s^2) \quad (3)$$

where:

x – Slope length (m)

s – Slope gradient (%)

The values of x and s were derived from study area Digital Elevation Model (DEM). To calculate the x value, Flow Accumulation was derived from the DEM after conducting Fill and Flow Direction processes in ArcGIS 10.3. Hence  $x = \text{Flow accumulation} \times \text{cell value}$  as in equation (4). Equation (4) was applied in ArcGIS 10.3 to generate LS factor map

$$LS = \left( \frac{\text{Flowaccumulation} \times \text{cellvalue}}{22.13} \right)^m (0.065 + 0.045s + 0.065s^2) \text{equation}(4)$$

### Computation of spatial distribution of potential soil erosion risk map (RUSLE<sub>potential</sub>)

Spatial variation of potential soil erosion risk map was generated by overlaying rainfall erosivity factor (R) map, soil erodibility factor map and LS factor map in ArcGIS 10.3.

**Computation of Cover management (C) factor for 1990, 2000, 2010 and 2015**

For this study, C factors for 1990, 2000, 2010 and 2015 were generated from the Land use/land cover shapefile map of the Isiukhu study area. Kenya soil database from world soil information of international soil reference and information centre (ISRIC) was used to produce the soil shapefile for the study area. The land use/land cover map was overlaid in ArcGIS. It was given spatial reference which was the same as the study area (WGS 1984 UTM Zone 37N). The study area was then clipped from the rest of the land use map feature. The land use/land cover map attribute table of the soil map of study area of each year (1990, 2000, 2010 and 2015) was edited with adding a new field of C factor values under the Edit menu at attribute view. Then under conversion in spatial analyst the feature (Isiukhu land use shapefile) using C factor as the field it was converted to Raster. The C factor used for different land use composition was tabulated

In this study, Fall's equation (5) was used in ArcGIS 10.3 environment to compute P factor values

$$P = (Fac) * 0.45249^{0.6} + (0.01745 * Slope\_degree) \tag{5}$$

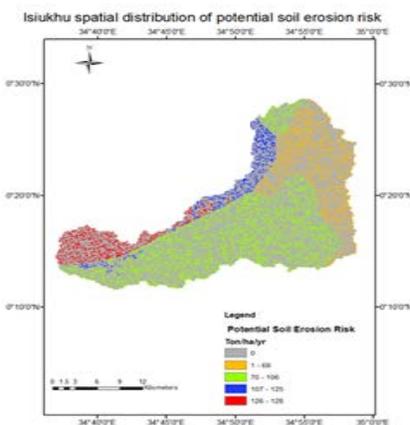
where; P is practice factor; Fac = Study area DEM flow accumulation; Slope\_degree = Study area DEM slope in degrees. As the first step, the elevation value was modified by filling the sinks in the grid. This is done to avoid the problem of discontinuous flow when water is trapped in a cell, which is surrounded by cells with higher elevation. This was done by using the Fill tool under Hydrology section found under Spatial Analyst Tool Function in ArcGIS. Then, Flow direction was generated from the Fill grid. The Flow direction tool takes a terrain surface and identifies the down-slope direction for each cell. This grid shows the on surface water flow direction from one cell to one of the eight neighboring cells. This was done by using the Flow direction tool under Hydrology section found under Spatial Analyst Tool Function in ArcGIS

**III. RESULTS OR FINDINGS**

**Spatial distribution of potential soil erosion risk (RUSLE<sub>potential</sub>)**

The spatial distribution of potential soil erosion risk showed that minimum potential soil erosion risk was 1 t ha<sup>-1</sup> y<sup>-1</sup>, the maximum is 128 ton ha<sup>-1</sup> y<sup>-1</sup>, the mean was 29 t ha<sup>-1</sup> y<sup>-1</sup> and the standard deviation was 46 (Figure 1)

Table 1: Spatial distribution of potential soil erosion risk



Classification of potential soils erosion risk (t ha <sup>-1</sup> y <sup>-1</sup> )	Area coverage (ha) (c)	Percent spatial distribution
0 - 12	5,000	7.3
13 - 25	12,000	17.6
26 - 69	19,882	29.1
70 - 106	19,807	29
107 - 125	10,245	15
126 - 128	1,366	2
<b>Total</b>	<b>68,300</b>	<b>100</b>

Figure 1: Spatial distribution of potential soil erosion risk map

In comparison with standard soil loss tolerance limit, only 7.3% (0-12 t ha<sup>-1</sup> y<sup>-1</sup>) of Isiukhu river catchment had allowable potential soil erosion risk (Bergsma 1986 and Thomas 1997). Above 90% of the catchment had 13-128 t ha<sup>-1</sup> y<sup>-1</sup> which was above soil erosion tolerance limit (Figure 2.4)

Based on spatial distribution, Isiukhu river catchment potential soil erosion risk was classified in six classes (Table 1). 0-12 t ha<sup>-1</sup> y<sup>-1</sup> covered an area of 5,000ha (7.3%), 13-25 t ha<sup>-1</sup> y<sup>-1</sup> covered an area of 12,000ha (17.6%), 26-69 t ha<sup>-1</sup> y<sup>-1</sup> covered an area of 19,882ha (29.1%), 70-106 t ha<sup>-1</sup> y<sup>-1</sup> covered an area of 19,807ha (29%), 107-125 t ha<sup>-1</sup> y<sup>-1</sup> covered an area of 10,245ha (15%) and 126-128 t ha<sup>-1</sup> y<sup>-1</sup> covered an area of 1,366ha (2%).

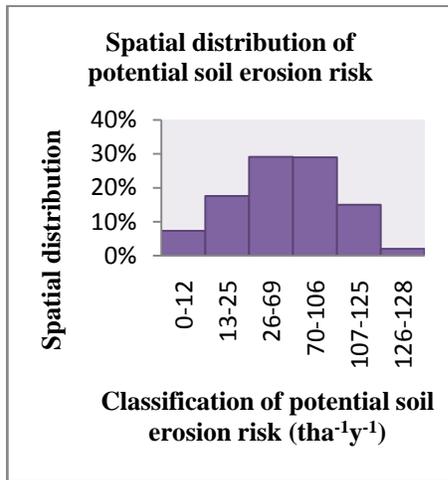


Figure 2: Spatial distribution of potential soil erosion risk

**Determination of actual soil erosion risk (RUSLE<sub>actual</sub>) using C factor of 1990**

To determine actual soil erosion risk for 1990 (RUSLE<sub>1990</sub>), R, K, LS and P factor maps were overlaid with C factor map of 1990 in ArcGIS 10.3 i.e.  $RUSLE_{1990} = RKLSC_{1990}P$

The spatial distribution of the actual soil erosion risk showed that 0-6 t/ha/y covered 11%, 7-7 t/ha/y covered 44%, 11-12 t/ha/y covered 29% and 13-13 t/ha/y covered 17% (Figure 4.20). The results indicated that there were five classes of actual soil erosion risk in 1990 with minimum of 0 t/ha/y and maximum of 13 t/ha/y. The mean was 2 t/ha/y indicating standard deviation of 4 (Figure 11). These results showed that in 1990, more than 85% of Isiukhu river catchment had soil erosion risk within tolerance limit 12t/ha/y for Kenyan soils (Thomas, 1997). Compared with potential soil erosion risk which had more than 93% above soil erosion tolerance limit, land use/land cover in 1990 of C factor 0.002 to 0.1 played a great role in reducing soil erosion risk.

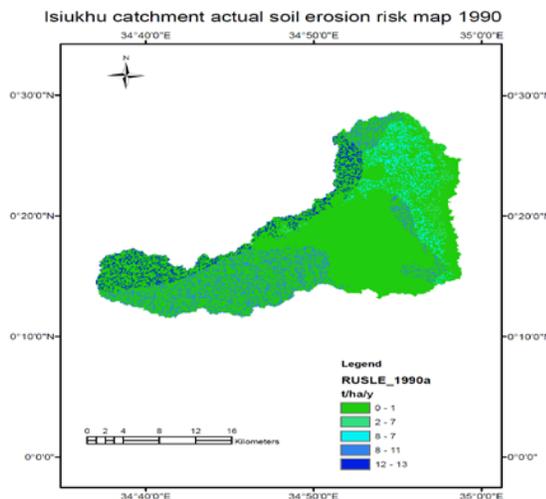


Figure 3: Isiukhu catchment actual soil erosion risk map 1990

Spatial distribution of actual soil erosion risk 1990 for Isiukhu catchment showed 0-1 t/ha/y covered 7,513 ha (11%), 2-7 t/ha/y covered 28,686ha (42%), 8-9 t/ha/y covered 683ha (1%), 10-11

t/ha/y covered 19,807ha (29%) and 12-13 t/ha/y covered 11,611ha (17%) (Table 8). The weighted mean (RUSLE<sub>weightedmean</sub>) for Isiukhu river catchment for 1990 was 7.2 t/ha/y with standard deviation of 3.994. Therefore in 1990, the weighted mean for soil erosion risk (RUSLE<sub>weightedmean</sub>) was below tolerance limit of 12 t/ha/y).

Table 2: Spatial distribution of actual soil erosion risk 1990

erosion rates (t ha <sup>-1</sup> y <sup>-1</sup> )	Mid-point (x)	Area (ha) (c)	cx	% spatial distribution
0-1	0.5	7,513	3,756.5	11
2-7	4.5	28,686	129,087	42
8-9	8.5	683	5,805.5	01
10-11	10.5	19,807	207,973.5	29
12-13	12.5	11,611	145,137.5	17
<b>Total</b>		<b>68,300</b>	<b>491,760</b>	<b>100</b>
<b>Weighted mean for 1990</b>			<i>RUSLE<sub>Widmean1990</sub> = 7.2</i>	

**Estimation of Isiukhu catchment actual soil erosion risk using C factor of 2000**

To determine actual soil erosion risk for 2000 (RUSLE<sub>2000</sub>), R, K, LS and P factor maps were overlaid with C factor map of 2000 in ArcGIS 10.3 i.e.  $RUSLE_{2000} = RKLSC_{2000}P$

The spatial distribution of the actual soil erosion risk showed that 0-2 t/ha/y covered 6%, 3-13 t/ha/y covered 20%, 14-20t/ha/y covered 27%, 21-23 t/ha/y covered 21 and 24-26 t/ha/y covered 26% (Figure 4.22). There were five classes of actual soil erosion risk in 2000 with minimum of 0 t/ha/y and maximum of 26 t/ha/y. The mean was 4 t/ha/y with standard deviation of 8 (Figure 4.23). These results showed that in 2000, 74% of Isiukhu catchment was having medium to high soil erosion risk (14-26 t/ha/y). Compared with actual soil erosion risk of 1990 which had more than 85% within soil erosion tolerance limit, land use/land cover in 2000 of C factor 0.003 to 0.2 had increased soil erosion risk by about 10% indicating worse land use/land cover management

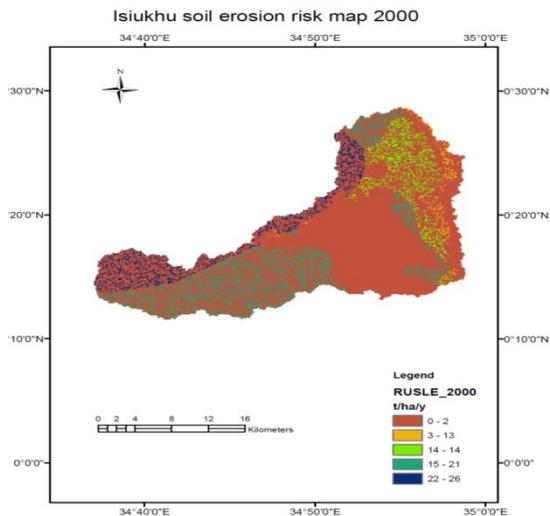


Figure 4: Soil erosion risk map 2000

Spatial distribution of actual soil erosion risk 2000 for Isiukhu catchment showed 0-2 t/ha/y covered 4,098ha (6%), 3-13 t/ha/y covered 16,392ha (20%), 14-20 t/ha/y covered 18,441ha (27%), 21-23 t/ha/y covered 14,343ha (21%) and 24-26 t/ha/y covered 17,758ha (26%) (Table 4.13). The weighted mean (RUSLE<sub>weightedmean</sub>) for Isiukhu river catchment for 2000 was 17.69 t/ha/y with standard deviation of 6.682. Therefore in 2000, the weighted mean for soil erosion risk (RUSLE<sub>weightedmean</sub>) was above tolerance limit of 12 t/ha/y by 5.69 t/ha/y. compared with 1990, soil erosion risk was higher by 10.49 t/ha/y (17.69-7.2).

Table 3: Spatial distribution of actual soil erosion risk 2000

erosion rates (t ha <sup>-1</sup> y <sup>-1</sup> )	mid-point (x)	Area (ha)	cx	% spatial distribution
0-2	1	4,098	4,098	06
3-13	8	16,392	131,136	20
14-20	17	18,441	313,497	27
21-23	22	14,343	315,546	21
24-26	25	17,758	443,950	26
<b>Total</b>		<b>68,300</b>	<b>1,208,227</b>	<b>100</b>
<b>Weighted mean for 2000</b>			<i>RUSLE<sub>Wtdmean2000</sub></i> = 17.69	

### Estimation of Isiukhu catchment actual soil erosion risk using C factor of 2010

To determine actual soil erosion risk for 2010 (RUSLE<sub>2010</sub>), R, K, LS and P factor maps were overlaid with C factor map of 2010 in ArcGIS 10.3 i.e.  $RUSLE_{2010} = RKLSC_{2010}P$

The spatial distribution of the actual soil erosion risk showed that 0-26 t/ha/y covered 2%, 27-41 t/ha/y covered 52%, 42-42 t/ha/y covered 28%, 43-48 t/ha/y covered 1% and 49-51 t/ha/y covered 17% (Figure 4.24). There were five classes of actual soil erosion risk in 2010 with minimum of 0 t/ha/y and maximum of 51

t/ha/y. The mean was 8 t/ha/y with standard deviation of 16 (Figure 13). These results showed that in 2010, 98% of Isiukhu river catchment was having high to very high soil erosion risk (27-51 t/ha/y). Compared with actual soil erosion risk of 2000 which had 74% of medium to high, land use/land cover in 2000 of C factor 0.03 to 0.3 had increased soil erosion risk by about 20% indicating worse land use/land cover management.

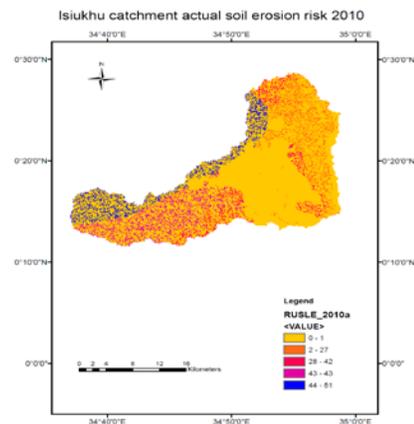


Figure 5: Soil erosion risk map 2010

Spatial distribution of actual soil erosion risk 2010 for Isiukhu catchment showed 0-1 t/ha/y covered 1,366ha (2%), 2-27 t/ha/y covered 35,516ha (52%), 28-42 t/ha/y covered 19,124ha (28%), 43-43t/ha/y covered 683ha (1%) and 44-51 t/ha/y covered 11,611ha (17%) (Table 10). The weighted mean (RUSLE<sub>weightedmean</sub>) for Isiukhu river catchment for 2010 was 25.855 t/ha/y with standard deviation of 13.635. Therefore in 2010, the weighted mean for soil erosion risk (RUSLE<sub>weightedmean</sub>) was above tolerance limit of 12 t/ha/y by 13.855 t/ha/y. compared with 2000, soil erosion risk was higher by 8.165 t/ha/y (25.855-17.69).

Table 4; Spatial distribution of actual soil erosion risk 2010

erosion rates (t ha <sup>-1</sup> y <sup>-1</sup> )	mid-point (x)	Area (ha)	cx	% spatial distribution
0-1	0.5	1,366	683	02
2-27	14.5	35,516	514,982	52
28-42	35	19,124	669,340	28
43-43	43	683	29,369	01
44-51	47.5	11,611	551,522.5	17
<b>Total</b>		<b>68,300</b>	<b>1,765,896.5</b>	<b>100</b>
<b>Weighted mean for 2010</b>			<i>RUSLE<sub>Wtdmean2010</sub></i> = 25.86	

### Estimation of Isiukhu catchment actual soil erosion risk using C factor of 2015

To determine soil erosion risk for 2015 (RUSLE<sub>2015</sub>), R, K, LS and P factor maps were overlaid with C factor map of 2015 in ArcGIS 10.3 i.e.  $RUSLE_{2015} = RKLSC_{2015}P$

The spatial distribution of the actual soil erosion risk showed that 0-3 t/ha/y covered 2%, 4-34 t/ha/y covered 5%, 35-52 t/ha/y covered 45%, 53-53 t/ha/y covered 21% and 54-64 t/ha/y covered 27%. (Figure 4.26). There were five classes of actual soil erosion risk in 2015 with minimum of 0 t/ha/y and maximum of 64 t/ha/y. The mean was 11 t/ha/y with standard deviation of 21 (Figure 14). These results showed that in 2015, over 98% of Isiukhu river catchment was having high to very high soil erosion risk (35-64 t/ha/y). Compared with actual soil erosion risk of 2010 land use/land cover in 2015 of C factor 0.02 to 0.5 had increased soil erosion risk by over 20% indicating worse land use/land cover management

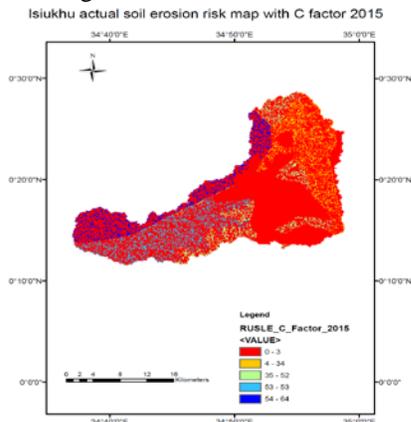


Figure 6: Soil erosion risk map 2015

Spatial distribution of actual soil erosion risk 2015 for Isiukhu catchment showed 0-12 t/ha/y covered 10,245ha (15%), 13-34 t/ha/y covered 26,637ha (39%), 35-51 t/ha/y covered 19,124ha (28%), 52-53t/ha/y covered 683ha (1%) and 54-64 t/ha/y covered 11,611ha (17%) (Table 12).The weighted mean (RUSLE<sub>weighted mean</sub>) for Isiukhu river catchment for 2015 was 32.660t/ha/y with standard deviation of 16.931. Therefore in 2015, the weighted mean for soil erosion risk (RUSLE<sub>weighted mean</sub>) was above tolerance limit of 12 t/ha/y) by 20.660 t/ha/y. compared with 2010, soil erosion risk was higher by 6.805 t/ha/y (32.660-25.855).

#### IV. CONCLUSIONS

This study has shown that by integrating RUSLE model factors in ArcGIS 10.3, it makes it possible to investigate both environmental and management factors independently. Catchment approach was applied to the study area to monitor the effects of anthropogenic pressure as a precursor to soil erosion risk. A digital elevation model of higher resolution can be used to compare precision before executing the model for determination of soil erosion risk.

#### V. ACKNOWLEDGMENT

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# Replacement Practice for Components, Essential Tools for Equipment and Machines Effectiveness in Industrial Production

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**Abstract-** Equipment Replacement is a part of maintenance given to a system to run effectively and efficiently. A lot of researchers have carryout much research work to determining the specific time of replacement through various models. Theory of replacement is normally concern with the problem of replacement of machines, man and decreased efficiency, equipments due to deterioration , break down or failure. Base on several research or studied by researchers on Replacement problem which is an essential theme in management science and operation research .Many writers have assumed that the framework in the working situation where degradation or wear of a unit can be measured and have formulate various models for replacement .

This paper work focus on Replacement Practice for Components, Essential Tools for Equipment and Machines Effectiveness in Industrial Production. the importance of replacement and defines the necessity of the replacement and highlights various reasons for replacement.

**Index Terms-** Replacement Reasons, Maintenance, Constant Usage, Qualitative Assessment.

## I. INTRODUCTION

In industrial sectors, the high rate of breakdown of production machine is one of the disturbances on the production flow lines or floor and this problem is affecting the profitability of the industry and the profit cannot be maximised due to maintenance cost and increasing production loss. Many time, this breakdown of machine is contributed by either single component failure or failures between components (Li and Thompson, 2005)

The major conflict lies in deciding that “Should we replace an asset that we own now or later”. This paper analyzing essential things that the manufacturers and owners needs to considered and supports them in taking their decision on the area of equipment and machine replacement by exploding the numerous possibilities of taking replacement decision Bharti Sahu (2013).

The purpose of replacement is to ensure efficiency, effectiveness, availability, reliability, maintainability, capability for the Economic life of the equipment and machine i.e. the period of time in terms of years that yields the minimum equivalent uniform annual cost (EUAC) of owning and operating an asset or equipment Nitin Kumar Sahu (2013).

**Effectiveness** is defined by an equation as a figure-of-merit judging the opportunity for producing the intended results. The effectiveness equation is described in different formats (Blanchard 1995, Kececioğlu 1995, Landers 1996, Pecht 1995, Raheja 1991).Each effectiveness element varies as a probability. Since components of the effectiveness equation have different forms, Definitions of the effectiveness equation, and it's components, generate many technical arguments. The major (and unarguable economic issue) is finding a system effectiveness value which gives lowest long term cost of ownership using life cycle costs, (LCC) (Barringer 1996a and 1997) for the value received: System effectiveness = Effectiveness/LCC

Cost is a measure of resource usage. Lower cost is generally better than higher costs. Cost estimates never include all possible elements but hopefully includes the most important elements.

Effectiveness is a measure of value received. Clements (1991) describes effectiveness as telling how well the product/process satisfies end user demands. Higher effectiveness is generally better than lower effectiveness. Effectiveness varies from 0 to 1 and rarely includes all value elements as many are too difficult to quantify. One form is described by Berger (1993):

Effectiveness=availability\*reliability\*maintainability\*capability. Reliability is defined as the probability that a device will perform its required function under stated conditions for a specific period of time. Predicting The Replacement theory is a decision making process of replacing a used equipment with a alternate substitute; mostly by a new equipment of superior practice. The replacement might be necessary due to the deteriorating property or malfunction or breakdown of particular equipment. Replacement Theory is used in many cases such as accessible items have outlived, or it may not be economical any longer to continue with them, or the items might have been ruined their life or destroyed either by accident or else, Anoop Kumar Sahu (2013). The life of any operating asset generally follow failure pattern and is represented by bath tub curve.

The bath-tub curve is a representation of the reliability performance of components or non-repaired items. It observes the reliability performance of a large sample of homogenous items entering the field at some start time (usually zero). If we observe the items over their lifetime without replacement then we can observe three distinct shapes or periods. Figure 1, shows the bath-tub curve and these 3 periods. The infant mortality or early failures portion shows that the population will initially experience a high hazard function that starts to decrease. This period of time represents the burn-in or debugging period where weak items are weeded out.

After the initial phase when the weak components have been weeded out and mistakes corrected, the remaining population reaches a relatively constant hazard function period, known as the useful life period. From figure 1, the hazard function is constant, this shape can be modelled by the exponential distribution, when failure are occurring randomly

through time. The final portion of the bath-tub curve is called the wear-out phase, this is when the hazard function increases with time. When the failure rate (number of failures per unit time) is plotted against a continuous time scale then the resulting curve is known as bath tub curve which exhibits three zones as shown in Fig (1) below:

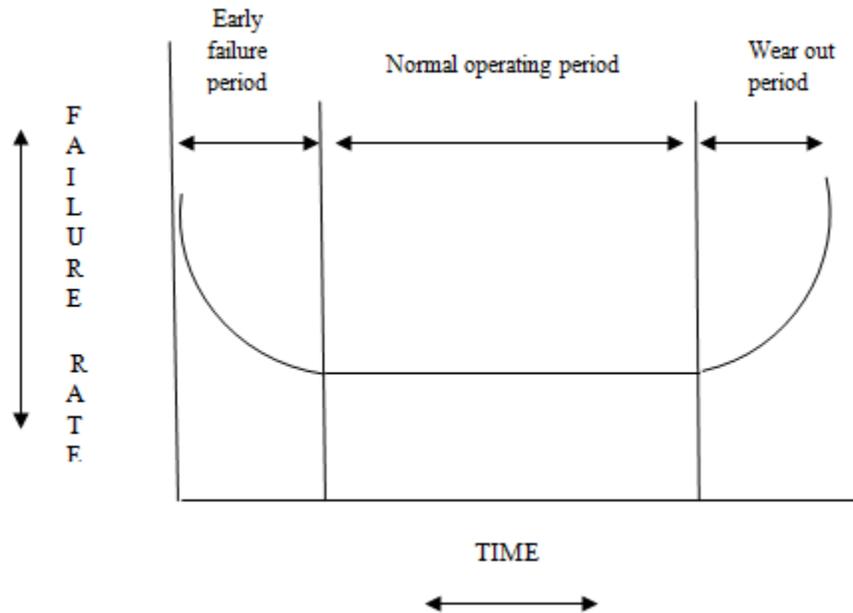


Figure: 1 Bath tub curve

In the third stage the curve represents high maintenance due to abrasion, creep, fatigue, corrosion, vibration etc. after the end of that phase the machinery generally replaces by the owner or manufacturer as it becomes useless as the metal becomes embrittled and the insulation dries out, Atul Kumar Sahu (2013). The work outline here shown that irrespective of the third phase of bath curve there can be the various different possibilities and

the unlikely cases which demands the requirement of replacement. the work presented would like to draw the attention of the owner in the field of replacement. The **Fig (2)** presented depicts the differential requirement of the maintenance action between the new and old equipment with respect to time.

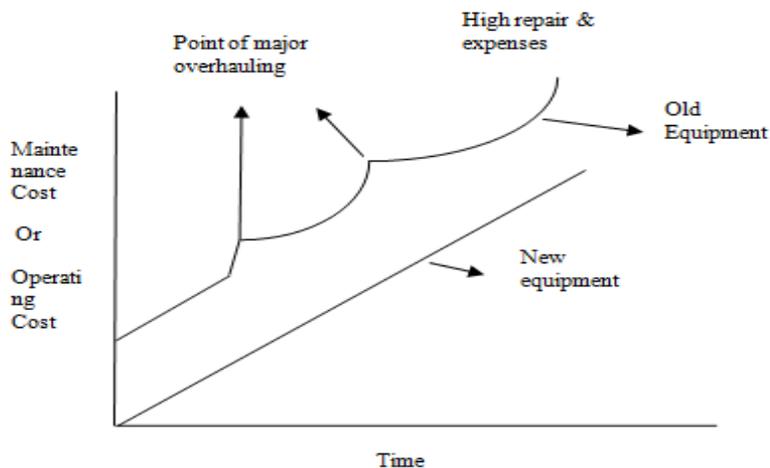


Figure 2: Differential requirement of the maintenance action between the new and old equipment with respect to time.

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cycle costs, (LCC) (Barringer 1996a and 1997) for the value received: System effectiveness = Effectiveness/LCC

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Effectiveness is a measure of value received. Clements (1991) describes effectiveness as telling how well the product/process satisfies end user demands. Higher effectiveness is generally better than lower effectiveness. Effectiveness varies from 0 to 1 and rarely includes all value elements as many are too difficult to quantify. One form is described by Berger (1993): Effectiveness=availability\*reliability\*maintainability\*capability. Reliability is defined as the probability that a device will perform its required function under stated conditions for a specific period of time. Predicting

**Life of the Asset**

The estimated life of an asset has a major influence on life cycle cost analysis. Ferry *et al* (1991) has defined the following five possible determinants of an asset’s life expectancy:

*Functional life* - the period over which the need for the asset is anticipated.

*Physical life* – the period over which the asset may be expected to last physically, to when replacement or major rehabilitation is physically required.

*Technological life* – the period until technical obsolescence dictates replacement due to the development of a technologically superior alternative.

*Economic life* – the period until economic obsolescence dictates replacement with a lower cost alternative.

*Social and legal life* – the period until human desire or legal requirement dictates replacement.

The cost of ownership approach identifies all future costs and reduces them to their present value by use of the discounting techniques through which the economic worth of a product or product options can be assessed(Woorward, 1997).

**Life Cycle Cost**

The life cycle cost of the equipment/machines is generally composed of original cost, salvage value, operating costs, maintenance costs, renewal costs, decommissioning costs and is represented by the following function :

$$F(x) = P-Q+R+S+T+U$$

**Where**

F(x) = Life Cycle Cost

P = Original Cost

Q = Salvage Value

R = Operating Costs

S = Maintenance Costs

T =Renewal Costs

U =Decommissioning Costs

When the average life cycle cost of the equipment is minimum, then after the end of that time span the replacement is usually preferable, the life cycle cost of the equipment generally deals with the quantitative assessment and deals with cost optimization. The work presented here shows the requirement of replacement based on qualitative assessment rather than quantitative.

**Figure 3: Reason for Replacement of Assets**

Opportunity of handling extra additional operations by innovative machines	Reduction in consumption of power or fuel by the innovative machine	Percentage increase in maintenance costs, decline in product quality	Reduction in down time by new machine due to breakdown or repairs
Deduction in scrap or spoiled work by new machines	<b>Reasons for Replacement of Assets</b>		Reduction in rate of output, increment in labor costs.
Fall in Profit and to stay rival in the market due to changed machinery			Smoky, noisy, hazardous working conditions and pollution by old machines leading to accidents and causing workers un-safety.
Development of lesser space requirement & new reliable machines	Depreciation due to wear and tear	Spare parts unavailability	Obsolescence as a result of technological expansion

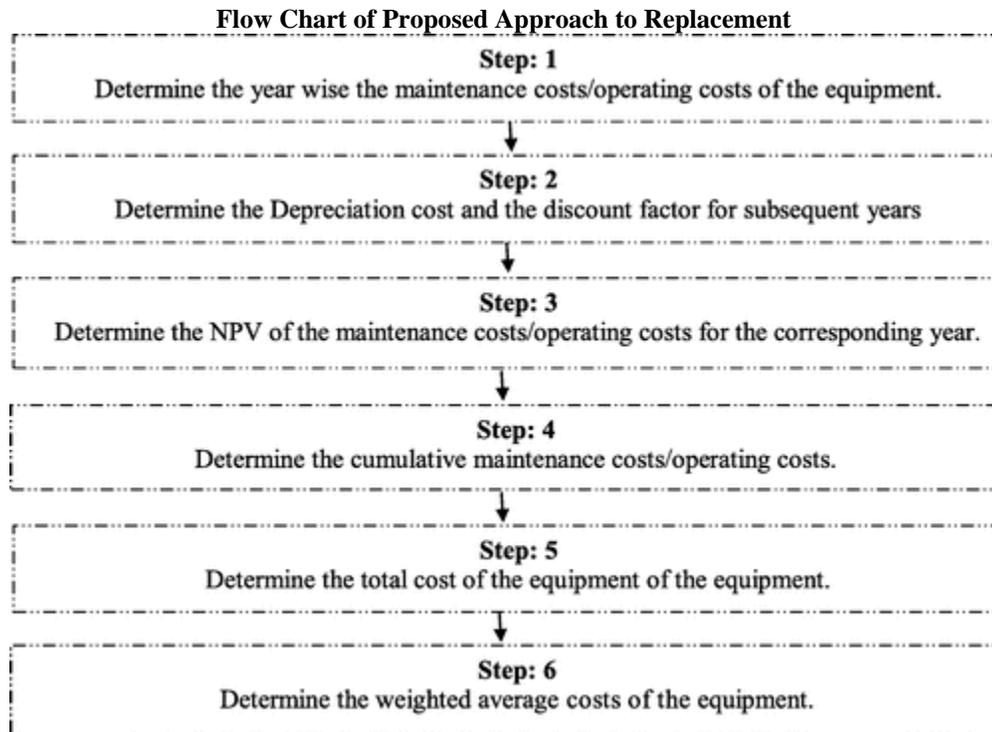
Large number of factors is responsible to replace the equipments before its estimated useful life .The various possible reasons which necessitate the replacement of equipment and machines are :

Depreciation of the equipments due to wear and tear

- Increment in maintenance costs, reduction in product quality.
- Decrement in rate of output, increase in labor costs etc
- Unavailability of spare parts
- Possibility of performing additional operations by new machines

- Obsolescence caused due to technological development
- Profit reduction and competitive strength of the firm to remain rival in the market due to changed machinery
- Change in product design or automation**
- Reduction in scrap or spoiled work by new machines.
- Reduced safety as compared to new machines available and developed
- Replacing old machines which creates unpleasant i.e. smoky ,noisy ,pollution and hazardous working conditions causing workers un-safety and leading to accidents
- More reliable machines developed
- Saving resulting from consumption of less power or fuel by the new machine

- High maintenance and repair cost of existing equipments and machines
- Improvement in quality and productivity by the use of new machine
- To reduce down time of existing equipments due to breakdown, repairs
- Reduction in the cost of jigs, fixtures, special tools etc by the use of new machines.
- Salvage value of new equipment and its useful life
- Lesser space requirement by the new machine



**Figure 4. Flow chart of proposed approach to replacement**

**Factor Affecting Maintenance Costs**

Maintenance cost could be affected by the following factors:

1. Supply responsiveness or the probability of having a spare part available when needed, supply lead times for given items, levels of inventory, and so on.
2. Test and support equipment effectiveness, which is the reliability and availability of test equipment, test equipment utilisation, system test thoroughness, and so on.

3. Maintenance facility availability and utilisation.
4. Transportation times between maintenance facilities.
5. Maintenance organisational effectiveness and personnel efficiency.
6. Durability and reliability of items in the system
7. Life expectancy of system
8. Expected number of maintenance tasks
9. Duration of maintenance and support task
10. Maintenance task resources

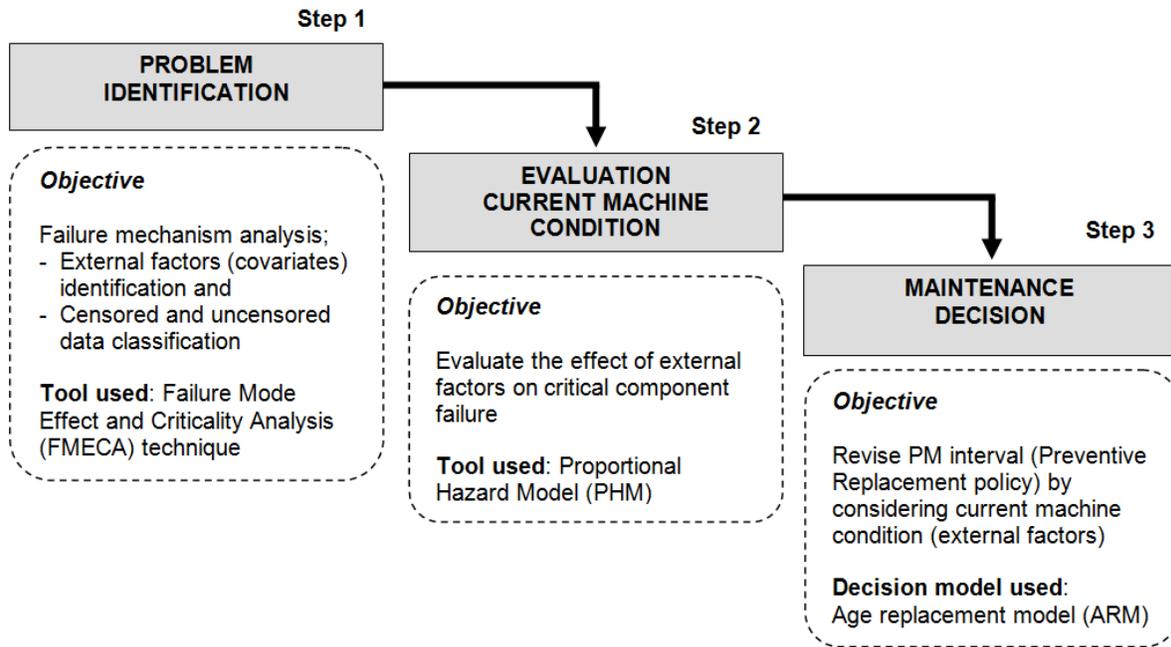


Figure 5: The general structure of the maintenance management decision model.

**Failure Forecasts and Predictions**

When failures occur in service, a prediction of the number of failures that will occur in the fleet in the next period of time is desirable, (say six months, a year, or two years). To accomplish this, a risk analysis procedure for forecasting future failures are developed. A typical failure forecast is shown in Figure 6, Cumulative future failures are plotted against future months. This process provides information on whether the failure mode applies

to the entire population or fleet, or to only one portion of the fleet, called a batch. After alternative plans for corrective action are developed, the failure forecasts are repeated. The decision-maker will require these failure forecasts to select the best course of action, the plan with the minimum failure forecast or the minimum cost. If failed parts are replaced as they fail; the failure forecast is higher than without replacement.

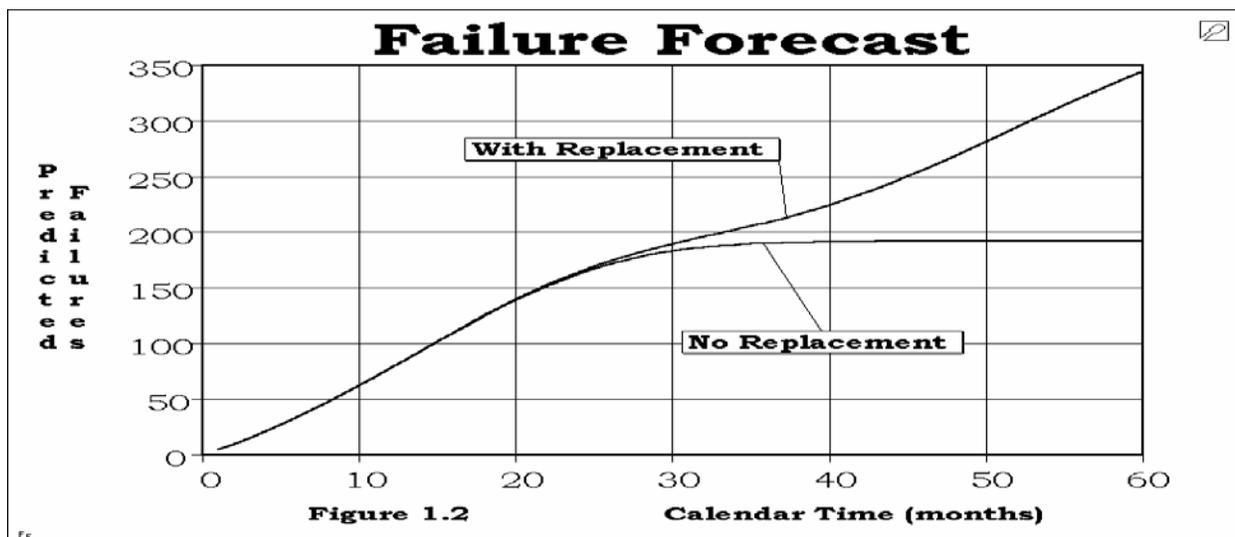


Figure 6 . Failure Forecast

**II. CONCLUSION**

Many researchers studied the machine replacement problem which is a significant area in operations research, industrial engineering and management science. Items which are under

regular and constant usage experience replacement at an appropriate time due to competence and efficiency of the working system. In the work we highlighted that many people feel that equipment should not be replaced until it is bodily and physically worn out. But, it is not right, operational equipment

must be regularly, persistently and constantly rehabilitated and modernized and updated to remain competitive and to retain efficiency otherwise it will be in the menace of malfunction or it may become obsolete and out dated.

The paper discusses the value and importance of replacement in production atmosphere. The objective of the proposed work focuses on Replacement Practice for Components, Essential Tools For Equipment And Machines Effectiveness In Industrial Production and striking a balance between the cost and the competitive environment. The possibilities of equipment replacement are discussed to ensure delivering the normal performance of the equipment. This script also discusses the life cycle and the life cycle cost of the assets. These work discussed with respect to the parameters like maintenance cost, time and obsolescence.

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# Mahatma Gandhi: A Revolutionary Transformer

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**Abstract-** Mahatma Gandhi was a pure soul, who was symbol of peace, spirituality and morality. He is always remembered for the great contribution of his hard work, simplicity, faith in truth, non violence, humanity, and unity. His actions and movements of Satyagraha, Non-cooperation movement, Dandi march, Quit movement have left an indelible mark not only in India but throughout the world. He had a burning spirit and patriotic fervor, his service to mankind was numerous. Gandhi has been aptly hailed as A Revolutionary Transformer of Management. He was a spiritual mentor and knows as a management reformer. His contribution to business management is remarkable and marvelous for history as well as present era.

Gandhiji had amazing knowledge of management and he used to this in his work. He is the politician, the philosopher, the socialist and the strong leader. He classified new dimensions of management that shows its importance in the corporate sector and set a strong place in it. No doubt he has magnetic personality which has a set of traits and skill and outstanding knowledge of management. This written report is a brief description of Gandhi's role of revolutionary transformation in management, activities and apparent motion which possess on new dimensions in modern business management concept.

**Index Terms-** Self Management, Time Management, Wealth Management, Resource Management, Stress Management, Emotional Intelligence, Communication, Turnaround Specialist.

## I. INTRODUCTION

Gandhian Concept of Management and Philosophy played an essential role in corporate world. His complete thinking about management was founded on love, trust and human goodness. He emphasized that the whole behaviour of human should be based on mutual love, trust and understanding. It was such a view of the great man and his world which was the core idea behind his philosophy. His philosophy gives an imprint in the corporate world.

## II. REVOLUTIONARY TRANSFORMATION IN MANAGEMENT

Mahatma Gandhi represented leadership and managerial abilities in the most numerous trying circumstances. Gandhi heightened management expertise in his entire life. Self-Management, Time Management, Stress- Management, Wealth Management, Resource Management, Emotional Intelligence, and Communication, Turnaround Specialist, all of these management disciplines are involved in their work and practice. These are following.

**1. Self- Management** - Self-management and a persistent conflict towards improvement was the trademark of Gandhi's ideas and patterns. His vows; Ahimsa (Nonviolence), Satya (Truth), Asteya (Non-Stealing), Brahmacharya (Self Discipline), Aparigraha (Non-Possession), Sharirshrama (Bread Labor), Aswada (Control of the Palate), Sarvatra Bhayavarjana (Fearlessness), Sarva Dharma Samantva (Equality of All Religions), Swadeshi (Use Locally Made Goods), Sparshbhavana (Remove Untouchability) which was used by him with spartan. These vows elucidate Mahatma's self-management concept that firmly followed by him in his whole life.

An example of Gandhian self management, when he went to the London for future study, before that he made a promise to his mother, Putlibai and his uncle, Becharji Swami that he would desist from eating meat, taking alcohol, and engaging in promiscuity. He kept that promise lifelong and became a strict vegetarian.

Self-management is about, acknowledging oneself, recognizing and accepting one's responsibilities, and mistakes also to moving onward in life. It is not only the work of perfection and faultless, but also determines tolerance for others' weaknesses.

According to Gandhian self-management – First a manager is a man and then a manager. He must have to learned to knowing itself which had helped him to controlling itself. It is important to understand needs of self management that a man can have managed himself, only then he will be able to control, manage and supervise others. It is subjective classification of management. In Indian business firms, institutions and organization should learn insights of self management and then other management area that can be termed perceived and practiced.

**2. Time Management**- Mahatma Gandhi was very punctual with esteem to the time and used to keep a dollar-watch in his pocket. He used to receive abundantly of letters and post-cards from all spheres of society, which was sent by the children, the artisans and the farmers too, he used to respond all those letters, without delay. It was such as the effective time management practiced by Mahatma Gandhi. Whenever he saw an injured or ill person he admitted them in the infirmary, and when he visited hospital to meet them he set beside them, he did not waste his single second of the spare time, and used their futile time in reading books or replying to the pending letters. He was continuing doing this practice of replying to the letters even after becoming a barrister too.

Mahatma Gandhi never said to anybody that he is too busy. Whenever people came to meet him for some work or problem, he did not refuse them even he was met to all persons. An open book is the best example of his life. He constantly held up to his moral values that he used in regardless of the situations

that preach by him to one and all. His concept of “walk the talk” had numerous followers in British camp, and many of them used to take swear of Gandhi's truthfulness. All this occurred due to his powerful and effective time management.

**3. Wealth management-**Gandhian philosophy of wealth management is based on Theory of Trusteeship. In this theory According to Gandhi, if a single person had an enough amount of wealth, inheritance, trade and industry, he must know that all that prosperity did not belong to him; what belongs to him was the right to a respectable living, nothing better than that delight by millions of others. The excess of his prosperity belonged to the community and must be utilized for the welfare of the society. Gandhi wanted the rich to grab their assets and properties as Trustee. Money cannot be made without labour. Gandhi ji knew that the power of labour was in its unity. When labour is organized together, it become more powerful than capital. The principle of trusteeship is bilateral. It is completely mutual affair of Capital and labour that determine that both capital and labour will be trustee, and will trustee of consumers also. According to this theory, capitalist and workers, both consider themselves as the trustees on behalf of the society in the entire process of production and distribution. This is an attempt to build up a great structure of equality based on industrialism.

In today's corporate world, the concept of Corporate Social Responsibility (CSR) is very essential and lies in the principle of Trusteeship which connects the Corporate Sector to the Social Sector. It is getting very popular in our society today, which does not encourage inequalities to grow. It asserted the fact that the business sector, which earns profit by selling their goods and services in the society also have some responsibility towards it. Gandhi focused on highest consumption of resources without exploitation of labour. This is crucial to achieve an inclusive society to promote growth with equity. The significance of trusteeship lies in transformation of the present capital system of society into an egalitarian one. This gives an opportunity to reform the present owning class. It is founded on the trust that human tendency is never beyond redemption.

**4. Resource Management-**When Indian economy was not as good and most of population sited idle, and youth became unemployed, Gandhi realized that it was a planning of the British to demolish the Indian textile market. It was a purely fait accompli that textile of India had gained ground in Britain and the British agencies were at loss severely so they had also banned the use of Indian textiles. Thus, Gandhi emphasized more on khadi industry because he knew that it can be redeveloped as a small-scale industry and people get maximum employment and no one can sit idle.

Gandhi initiated the views of noncooperation and he knew that to make the people adhere to it, he needed to bring them under the swadeshi fold. He knew that the operating of British goods could be barricade for encouraging people to resuscitate and revitalize their own business. Gandhi focused on full consumption and maximum utilization of resource without exploitation of labour. Gandhi ji knew the importance of producing good and its results even from limited resources that also a thing which made Gandhi as a successful business leader.

**5. Stress Management-** Gandhi ji had a good sense of humour which he used to reduce stress. When he felt disconsolate he read Bhagavad Gita. Gandhi was a karma yogi who tried usually various Yama and Niyama, He did yoga asanas, simple pranayama, massage, drinking water through the nose etc. to maintain his body fit and free from diseases and fatigue. Gandhi believed in Dhyana (meditation), samadhi (attainment of the super conscious state), and Dharana (concentration of the mind) its avoid depression and mental exhaustion, attain and maintain physical and mental wellness and relax them. Yoga enables to discover empowering to the individual physically, mentally and spiritually. Gandhi ji used remedies such as positive thinking, meditation, internal peace and skill of nonviolent to reduce stress. Today's managers should conduct laughing class, yoga class for employees or Gita path as stress busters.

**6. Emotional Intelligence -**Emotional Intelligence defined as the mental ability for recognizing our beliefs and others also, and motivating itself, managing emotions for better in relationships.

Mahatma Gandhi was a social star and always focused to excel skills to do well in anything that relies on interacting smoothly with others. He was a charismatic person that has a high intelligence quotient (IQ) and high emotion intelligence (EQ) also, and always manage his emotions or understand other emotions as well, he always motivates himself and others too. He possessed a big sense of handling a relationship. Mahatma Gandhi was a heroic team player to able to create coordination in the effort of people and played a role of negotiator to negotiate the problem and give solutions of complex interpersonal problems. he is being good at giving others feedback that did not make them angry.

Gandhi defeated his distress, fear, anger and panic. He said at once, “Patience and perseverance can overcome mountains”. His ability of not compromising his values, explaining it to following a chosen path in faith are indications of high emotional intelligence. Emotional intelligence is understood in the persuasion with which one stands by his decisions and owns up accountability.

**7. Communication-** Hindi was not the mother tongue of Mahatma Gandhi. Hindi was not as common language to use then as spoken now. In Central Indian states schools except were not taught Hindi subject. Despite all these barriers, Gandhi could connect across India. He knew how to communicate with the crowd and how to a locally prominent leader ensuring his appearance and create effective and attractive speech. It shows his strength to unify a large number of people and leveraging it for communication for the common reason and objective.

During life journey of Gandhi has so many instance, where his management accomplishment came in the front and twisted the situation. He was proved his skill of negotiation in the agreement with British government during IInd world war, which was milestone to Indian Independence in 1947.

**8. Turnaround Specialist-** If we placed Mahatma Gandhi in modern management framework, he was a ‘turn-around specialist’. In modern corporate world, turn-around specialist is a

business leader who unlocks the potential of a company and open the new door of opportunities for achievement and takes a company in to new heights. Most important things in being turnaround specialist are that company has done great in the past but due to several reasons (external and / or internal to the society), it's not doing great right away. Turnaround specialist is the one who would get not only a company in to the next height but also repaired its history and achieve goals of its organization, and would get ready to across the changes. Mahatma Gandhi had these skills, when we talk about India's history we can understand that how he to expelled the British from India and gave it freedom and conveyed India up to the next heights.

### III. CONCLUSION

Gandhian philosophy and his actions give to world new dimension in the field of management, his massive structure of truth, love and non-violence given an important change not only in management but in human life also. It is a revolutionary transformation in the area of management. It defines new core values of management. Equally we recognize that most of the corporate and competing institutions often issue their mission statements in which they declare their philosophy by defining their identity and staying in broad terms their intent or goal, competitive edge or strength, target groups and markets in the economic system.

- i. If in large number of industries or business men should understand the relevance of trusteeship theory, that helps to resolved labour conflict in India.
- ii. Corporate sector should accept and follow the ethics of corporate social responsibility (CSR) and establish the working environment heartiest, comfortable, peaceful, undiscriminating, and moralistic.
- iii. A manager should be in discipline and have control in their emotions. Self- management is essential part of management.
- iv. Leaders should recruit his team on the basis of production capacity and ability of them and contribution of their work

to achieving organizational goals and objectives, rather than who they are and which culture they adopt.

If corporate world will understand the relevance of Gandhian concepts of management and pressed into service his theories in organization that helps to provide better platform and ethical, spiritual, valuable and moralistic environment for capitalist, labour and consumers. And it will ensure success as easy as blinking of eye to every business unit or organization.

In the corporate world, every business expert admires Gandhian Concept of Management. Modern business gurus are talking about a new role model: Mahatma Gandhi A multidimensional personality. The Father of the Nation is now become the master strategist, an exemplary leader, and someone whose ideas and strategies given revolutionary transformation in the corporate sector in India.

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# IMPACT OF OWNERSHIP STRUCTURE AND CASH FLOW ON CORPORATE DIVIDEND POLICY IN PAKISTAN: KSE 30 INDEX

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**Abstract-** This research aims to comprehend the impact of ownership structure and Cash Flow on corporate dividend policy in Pakistan: KSE 30 Index. Data was collected from thirty companies which are listed in the Karachi Stock Exchange from randomly which paid the dividend regularly from the period of 2004 to 2014, in this Study includes variables like Dividend Payout ratios dependent and ownership structure, Quick Acid test Ratios, Price Earnings Ratios, Financial Leverage Ratios, Debt to Equity Ratios, Net Profit Margin, Return on Assets, and Cash Flow these are independent. The result of the study proved that ownership structure is dummy variables, Quick Acid test Ratios, Price Earnings Ratios, Financial Leverage Ratios are strongly relation among the dividend payout Ratios. Debt to Equity Ratios, Net Profit Margin, Return on Assets, and Cash Flow is also related positive relationship. This research offers imminent guidelines to the policy and decision makers in any type of firms to take good decision to set their firms hierarchy system.

**Index Terms-** Dividend, Pakistan Stock Exchange thirteen Firms'

## I. INTRODUCTION

Dividend policy may be a few of the loosely self-addressed subjects in up to date financial literature. Many researchers try to discover the matter concerning the dividend conduct or dynamics and determinants of dividend policy however we tend to still don't have an applicable reason behind the determined dividend conduct of companies (Black, 1976; Allen and Michaely, 2003 and Brealey and Myers 2005). one in every of the wide famed motives of dividend behavior is that the smoothing of firm's dividends vis-a-vis financial gain and increase. In his seminal studies, Lintner (1956) discover that corporations within the u. s. of america alter their dividends swimmingly to keep up a target long run payout quantitative relation. various analysis appear once this paintings and proof endorse that the dividend policy of the organizations varies from U.S. of a to country thanks to varied establishments and capital marketplace variations.

Dividend alternative is crucial for each the investors and businesses. it's miles the selection of business enterprise's management that what proportion of the earnings have to be compelled to be endowed and what share need to be disbursed to shareholders as dividends. Whereas creating this alternative the management considers accessible funding prospects that may increase destiny financial gain and if such opportunities are not to be had the management ought to distribute the earnings to shareholders. (Miller & sculpturer, 1961)

The conventional read of the dividend choice states that at a selected time the number of coins paid of late as dividend is larger precious than the maintained coins. the traditional read argues that paying early dividends might not alternate the corporate threat degree but it will alternate the notion of the capitalist concerning the enterprise's likelihood stage for this reason dividends area unit bigger precious than maintained financial gain.

In imperfect marketplace consumers elect businesses with a dividend sample almost like their intake sample is often| the explanation several teams follow a continuing dividend coverage and their management bear in mind discount in dividend as a weakness signal and consequently a better dividend would handiest be introduced if the corporate can maintain it in future.

Traders have incomplete records in imperfect market. less quantity of knowledge is offered thus one thing is offered is taken into thought as essential one by suggests that of the investors. Assertion of dividend is taken as sign of destiny boom of the business. Most of those factors show the importance of dividend and its relevancy.

The Pakistan's capital marketplace and also the national economy have many important functions for analyzing the dynamics of dividend policy. 1st of all, Pakistan is moving toward the event and enhancing the national economy position within the world for the explanation that 1980.1 The capital markets of Pakistan area unit an honest deal develops as before2. several studies end that companies area unit altogether probability to pay solid dividend at some stage within the high growth length and it's attention-grabbing to find that however dynamic dividend policy is set in developing economy like Pakistan. Secondly, thanks to vulnerable company governance the possession structure of Pakistani corporations is often characterized by manner of the dominance of one primary owner United Nations agency manages an oversized kind of connected corporations with simply atiny low amount of stocks

or funding that lead to the organization battle among the shareholders and also the man of affairs, whereby dominant shareholders confiscate worth from minority shareholders and will influence the dividend policy simply. Thirdly, the tax atmosphere in Pakistan is completely one in every of a form as compare to advanced markets. there is also no financial gain tax on shares in Islamic Republic of Pakistan at a similar time as 100% income tax is charged on dividend earning and it's miles essential to say right here that if the businesses earned the earnings and no longer introduced the dividend that the thirty fifth of the profits tax is charged through the authorities of Pakistan. there's a chance of variations within the legal system might have an impact on the dividend coverage and in addition have an impression on the sheepskin of dividend smoothing in Pakistan after you take into account that this unfavorable tax treatment of dividend profits may be a bigger serious problem than the developed countries like America. Fourthly, inside the Pakistan the payment of dividend is voluntary. In Korea as associate degree example, it's miles obligatory for indexed organizations to pay the once a year dividend divided through its face price at a degree same to the interest worth of 300 and sixty 5 days certificate of deposit. In truth, in Pakistan the many major traders area unit still disagreed with dividends and do not forget inventory charges appreciation as a result of the first issue of inventory returns consequently, it's miles assumed that capitalist mind-set toward dividends is anticipated to own an impact on the way whereby companies set their dividend policy in Pakistan.

Earnings area unit thought of a souvenir for fairness holders. but, the charge of dividends isn't obligatory. In observe, the dividend choice agency costs (Jensen's, 1986; Easterbrook, 1984) area unit related to (lease ET al., 2000), the firm's funding opportunities, leverage and finance choices accessible (Smith and Warner, 1979; Rozeff, 1982) fashionable, earnings and private tax (Brennan 1970), the preferences of assorted businesses of investors effects (John and Williams, 1985), internal and external to the relative energy (la orifice and al ET al., 2000), and also the charge of dividends and destiny clientele (Lintner, 1956; Brav ET al., 2005). a large amount of studies during this location, in spite of the theoretical and realistic researchers profits (Black, 1976) become a puzzle. in a very resistance international, dividend payments created investors returns domestic (Miller and Modigliani, 1958, 1963) is also generated from the worth of a firm is inappropriate. however, abundant less-than-perfect markets, a most dividend payout quantitative relation is further than the value of the firm. as associate degree instance, various theoretical and wise take a glance at facts spatiality among managers and external shareholders whereas earnings is also used as a signal tool show. (Bhattacharya...1979..Miller & Rock., 1985& Ambarish ET al.,1987) were boom or lower within the earnings of a company's destiny profits argued that send alerts. However, latest tests for signal model is found to be weak empirical aid this is often indicated (DeAngelo ET al., 1996. Benartzi ET al., 1997.)

Relatively less economical markets, dividend payment policy, the agency model within the context of a additional powerful rationalization has emerged. In place of work framework, monetary economists outline 2 opposite for dividend payment supply. Hart and Moore (1974), Jensen's (1986), Fluck (1998, 1999), Zwiebel (1996), Myers (1998), Easterbrook (1984) and Gomes (2000) studies, the income edges managers I counsel to facilitate the famine of prudence and / or external force managers to look at the markets during which they're subject, to induce outside finance. The agency perspective, there's a powerful preference for associate degree out-profits would expect. Agency Model Extension, (1982) Rozeff dividend payments to the firm's agency prices and dealing prices is that the results of a trade-off between the conjectured. The dividend price reduction model (DCM) because the model is named. The dividend payment are going to be subject to external finance firm belief that top dealing prices if the agency problems to beat the minority shareholders can demand additional profit, however, for the good thing about their shareholders i'll be forced to lower their demands. However, La Porta's ET al. (2000) returns voluntarily and isn't paid by the management of a legal system; the rights of minority shareholders set the dividend payout quantitative relation that argument. The rights of minority shareholders, if, through varied ways will force management to pay dividends. The thirty three countries through a sample of four1,000 corporations found support for his or her hypothesis. La orifice a powerful explanation for the ET al area unit of the read that there's. significantly developing economies, wherever company governance indices area unit lower and also the rights of minority shareholders (2000) argument don't seem to be well protected. Agency models profit squeeze out minority shareholders and corporations will cut back agency prices relies on the idea that. However, this assumption legal and governance systems in developing economies, given the imperfections could appear irrational. Agency theory Fish celebrated throughout the capital structure as a plausible rationalization for the variation is advanced. Johannes Vilhelm Jensen and Meckling (1976), a manager of the company's capital structure to reduce their impact on the worth of the equity price of agency debt agency counsel that the value is adequate the balance.

It should be actually powerful for vulnerable external shareholders to pressure nicely-entrenched managers or a giant inside-block holder to pay dividends in a very vulnerable criminal contraption. the explanation of this have a glance at is to through empirical observation examine the on top of hypotheses employing a sample of Pakistani listed corporations. In Pakistan, the possession form of corporations is totally different from those of the Anglo Saxon international locations a bit like the United country and also the Great Britain wherever spread shareholdings area unit omnipresent. Pakistan lacks extensively control organizations. The possession of the corporations is targeted in some hands, with massive shareholders having enough incentives and capability to manage. those settings is also accustomed check the validity of l. a. orifice et al. (2000) speculation in assessment to the dividend fee reduction hypothesis. the overall material of this paper is extensively in line with that of l. a. orifice et al. (2000). but, our paper is totally different from theirs on cash owed. First, we tend to use a within-u . s . a . sample and distinguish between one in every of a form lessons of shareholders on the thought in their relative powers to force corporations to disgorge coins. for example, we tend to reckon that outside character shareholders area unit incapable of forcing entrenched managers to pay dividends. therefore dividend payout quantitative relation may well be negatively related to the possession proportion of individual shareholders. In distinction, the dividend price reduction model of Rozeff (1982) implies a positive relationship among the 2. additionally, we tend to proxy the traders powers with the possession % of

institutional consumers, United Nations agency have the comparative benefit of good thing concerning } information and being vocal about their rights. Being bigger powerful than man or girl investors, they will force corporations to pay dividends.

The study makes many contributions to the literature. First, this paper considerably examines the association among possession variables and dividend coverage in Pakistan. This location has attracted very little interest of empirical researchers in Pakistan for the plain reason behind non-availability of possession form statistics in associate degree ready kind. The few gift analysis during this material in Pakistan lack rigor no longer handiest in terms of facts set and short amount of possession variables, however in addition in terms of right economics modeling. Secondly, this take a glance at extends the worth reduction version of Rozeff (1982) by suggests that of cacophonous the statistics attack the idea of fiftieth score of possession variables. we tend to speculate and check that the results of dealing prices and leader fees on dividend payout quantitative relation don't seem to be instantly-ahead; as another the presence of one moderates the impact of the choice on dividend coverage. This conjecture permits U.S. to separate the records into subsamples victimization the fiftieth %iles of the possession variables like percent of possession control by victimization institutional traders, out of doors individual investors, directors (insiders) and connected corporations.

Jensen and Meckling by victimization shareholders on the value of the corporate conception managers enhance their own well-being is perhaps to lead to suboptimal alternative, the pastimes of shareholders and executives of a firm, there is also a seasoner war posits . Among proprietors and managers perceive the impact of those conflicts, the market is impartial such prices and expected worth of the shares reduces the firm. This lack of equity price of the firm has agency.

Agency many ways in which to unravel issues and are urged to scale back the attendant prices. These practices encourage external management devices or mechanisms either constitute 2 classes. Within the latter cluster, the house owners and managers to align the interests of managers how to bring the firm (Jensen and Meckling, 1976) to extend their possession is due. Johannes Vilhelm Jensen associate degreed Meckling projected by neutralizing an equity investment in in our own way, is to extend the utilization of debt finance. The management of the equity possession rates increase, the equity base shrinks. the utilization of credit not solely to align the interests of managers and house owners of works, however bankruptcy and job loss will increase the possibilities. Manag- ers will encourage additional risk edges embody reduced their consumption and performance (Grossman and Hart, 1982) to extend. Another advantage of victimisation the loan takings (Jensen's, 1986) may be a answer to the matter of maintaining additional.

The study of those corporations within the dividend policies of the corporate official report views. within the world of taxation and dealing prices, the payment of dividends needs some rationalization, before June 2010, no capital gains tax in Pakistan to the shareholders of such profits area unit less theoretical blessings, particularly wherever the re-investigation of the matter a very appropriate context, provided, was there.

The level of dividend and payment strategies (cash or shares) the selection of a way to discovered the businesses, the paper adopts a behavioural approach, and also the u. s. hold the first task of Lintner (1956) builds on. Lintner methodology conjointly works within the same manner within the context of education relies on the results of a series of (.; Baker and Powell, 1999; Baker ET al., 1985 Brav ET al., 2005), Great Britain (Dhanani, 2005) and eire (McCluskey withdraws ET in al., 2007). little analysis of the structure of taxation, despite the fast development and uncharacteristic Pakistan is that specialize in rising markets; exceptions to the present generalization liveliness and Bilgrami (1994), Kanwar (2002), Naeem and Nasr (2007) and Ahmed and Javed (2009) area unit enclosed. However, none of these interviewed already use study examined the behavioral aspects of dividend policy; instead, they combination victimization multivariate analysis examined the company's dividend payments. this paper is thus comprehensive that the primary arrange to build a contribution within the space in these firms' dividend decision-making method concerning the impact of a series of interviews with executives of the corporate reports results.

Dividend policy behavior in finance literature and also the most debate able issue each in developed and rising markets is that the distinguished place Dividend policy behavior in finance literature and also the most debatable issue each in developed and rising markets is that the distinguished place. Several researchers dividend and dividend policy determinants of behavior or the dynamics of the matter, however we tend to still try and uncover "t corporations (Black, 1976 a suitable rationalization for the discovered dividend behavior, 2005 Allen and Michaely, 2003 and Brealey and Myers). dividend describe the behavior of leading a firm "s revenue and profit growth vis power tool than A-. u. s. corporations within the long-run target payout quantitative relation to keep up their profits simply accommodate these basic analysis, Lintner (1956) realize. This work demonstrates the companies' dividend policy and capital market establishments vary from country to country attributable to variations counsel that once many studies showed. Pakistan dividend policy and capital market economic dynamics to research many vital options. First, Pakistan area unit moving towards the event of the capital markets since 1980.1 positions within the world economy is up before2 as several area unit prepared. several studies corporations stable throughout the amount of high growth is anticipated to pay a dividend and the way it complete that dynamic dividend policy in growing the economy of Pakistan is decided to seek out attention-grabbing. Secondly, due to a results of weak company governance structure of the corporations closely-held by the shareholders as a result of the conflict between the agency that solely a tiny low quantity of shares or investment related to variety of corporations Management is characterized by the dominance of a primary owner dominant shareholders and minority shareholders holding the worth will simply have an effect on dividend policy, wherever the third than in developed markets, Pakistan The tax atmosphere is totally different. There the ten income tax on dividend financial gain has suspect the Pakistan financial gain on stocks and corporations tax3 profit and not tax by thirty fifth charged the dividend is said, it's vital to say here that the govt of Pakistan. have an effect on dividend policy and dividend financial gain once the adverse tax treatment of dividend in Pakistan will have an effect on the degree of smoothing the variations within the tax systems of developed countries just like the u. s. than probably a additional major problem. Fourth, the dividend payment is voluntary

in Pakistan. the businesses collect a year's time, interest rates at tier comparable to the annual dividend divided by the worth, for instance, in Korea, it's obligatory. In fact, several major capitalist in Pakistan area unit still variations of profits and thus stock costs of stock as a part of the come back on the definition, by its profits on the investment behavior of corporations is anticipated to own an impression is assumed that the dividend policy in Pakistan.

Several researchers' dividend and dividend policy determinants of behavior or the dynamics of the matter, however we tend to still effort & uncover "t company (Black, 1976) a suitable rationalization for the discovered dividend behavior, 2005 Allen and Michaely, 2003 and Brealey and Myers). dividend describe the behavior of foremost a firm "s returns and profit enlargement vis power tool than A United Stat corporations within the long-run target payout quantitative relation to keep up their profits simply accommodate these basic analysis, Lintner (1956) realize. This work demonstrates the companies' dividend policy and capital market establishments vary from country to country attributable to variations counsel that once many studies showed. Pakistan "dividend policy, capital market and economic dynamics to research many vital options. First, {pakistan|Pakistan|Islamic Republic of Pakistan|West Pakistan|Asian country|Asian nation} and Pakistan area unit moving towards the event of the capital markets since 1980.1 position within the world economy is up before2 as several area unit prepared. several studies corporations stable throughout the amount of high growth is anticipated to pay a dividend and the way it complete that dynamic dividend policy in growing the economy of Pakistan is decided to seek out attention-grabbing. Secondly, {due to|because of|owing to|as a results of|thanks to|attributable to} weak company governance structure of the corporations closely-held by the shareholders as a result of the conflict between the agency that solely atiny low quantity of shares or investment related to variety of corporations Management is describe by the ascendancy of a most important owner dominant shareholders and minority shareholders holding the worth will simply have an effect on dividend policy, wherever the third than in developed markets, Pakistan The tax atmosphere is totally totally different. There the ten income tax on dividend financial gain has suspect the Pakistan financial grow on stocks and corporations tax earnings and not tax by thirty fifth charged the dividend is said, it's vital to say here that the govt of Pakistan. have an effect on dividend policy and dividend financial gain once the adverse tax treatment of dividend in Pakistan will have an effect on the degree of smoothing the variations within the tax systems of developed countries just like the u. s. than probably a additional major problem. Fourth, the dividend payment is voluntary in Pakistan. the businesses collect a year's time, interest rates at tier comparable to the annual dividend divided by the worth, for instance, in Korea, it's obligatory. In fact, several major capitalist in Pakistan area unit still variations of profits and thus stock costs of stock as a part of the come back on the definition, by its profits on the investment behavior of corporations is anticipated to own an impression is assumed that the dividend policy in Pakistan.

Hypothetical and reasonable evidence dividend and dividend indication performance plays a very important role in explaining the agency's prices associated with the governance of the firm counsel that bound factors area unit gift. Pakistan's primary focus is to through empirical observation study the market behavior of the dividend smoothing "the firm will make a case for cross-sectional variations area unit to look at factors. whistle profit primarily attributable to scrutinize the recital of companies that dividend influences the capital structure. The concentration of the possession of such corporations, profitability, liquidity, size, leverage and investment opportunities, as is that the role of different determinants of Karachi Stock Exchange 320 non-financial companies within the sample by victimization the payment behavior The dividend for the amount from 2001 to 2006.

This contributes to the restricted literature and Lintner (1956), Fama and Blahnik (1968) and al Belanes ET He enlarged the standard framework. this study evaluated the policies of the dividend in Pakistan conjointly highlights the factors concerned in. we tend to controlled corporations future revenue and profit growth signals , firm size, money balance are often accustomed try and realize that out, revenues, capitalization maintained. In Pakistan area unit perpetually paying dividends area unit many corporations. we tend to metropolis exchange (KSE) The profits of those corporations don't seem to be able to swish dividend policy to subvert or area unit in Pakistan, what area unit the factors why try and realize the solution.

Dividend policy wide in fashionable economic literature is one in every of the topics self-addressed. the worth of the firm's perceived importance in determinative dividend policy theories indefiniteness of the researchers, one in every of the foremost contentious problems is created. This discussion sculpturer and Miller (1961) has roots back to the most task, that inflated the firm's dividend payment valuable and ideal capital market price of a firm's dividend call doesn't have an effect on that The common belief is challenged. On the opposite hand, Lintner (1962) and Gordon (1963) were argued in the bird hand theory that high-dividend paying high worth is related to the firm. The on top of discussion has currently was the monetary literature, however the difficulty (1976) with black items doesn't work as a "puzzle" is that the purpose wherever a similar is stagnating. No single issue alone dividend behavior (Anil and Sujata, 2008) will make a case for that there's associate degree rising accord. monetary researchers dividend, together with possession structure area unit vital choose that firm-specific factors, has known a kind.

Its shareholders by actively managing a firm's dividend control where supervision is absent provides indirect benefits, arguing that the current corporate ideology of "agency problem" (Jensen's, 1986 Easterbrook, 1984) affiliation among dividend behavior and ownership structure support (Rozef, 1982). Jensen and (1976) Meckling the managers, but the ultimate owners of the company have made will align the interests of managers and shareholders, the internal growth in the ownership of the firm that may have reduced the price Agency will provide increase to new conflicts of attention among. Furthermore, "customer impact model", investors pay a dividend policy best investors and capital gains tax treatment on the face and the securities trade because the cost of their investment objectives of the Company are attracted that argument. Therefore, the preference dividend and capital gain, their dividend policy, which associated with their investment strategy is forced to choose a company which created clientele. Capital gain is exempt from tax altogether, while in the context of the tax system, dividend tax is deducted at source. Therefore, these investors, especially those from small holdings to achieve profits more investors prefer to note that is not surprising.

In addition to the ownership structure, the company's financial and liquidity position to determine the level of dividend plays an important role. If a company is facing liquidity problems of the stock dividend instead of cash dividends may like to choose. Jensen's (1986) hypothesis of free cash flow, companies already investing in profitable projects prefer to use cash resources and profits are paid out of balance. For the first time introduced the concept of the separation of ownership and management means that Berle (1932), (Afza and Slahudin, 2009 cited in), Administration for profitable investment opportunities in excess of cash resources Use of passive causes, argued that the conflict between ownership and management interest. Dividend and interest payments due in less profitable projects or managers' requirements to reduce the likelihood of its use, free cash flow for management reduces available. From the point of view of companies, operations generated cash payment plays an important role in deciding, higher cash flow from operations generated negative operating cash flow of the company instead of cash dividends paid to companies is expected to be in a better position. Earnings in cash, keep the greater part of the report for future investments in profitable projects (Khurana and. al., 2006). Almeida et. Al. (2004) firms facing financial difficulties to fund future investment opportunities that will save cash over the pointed out. Intuitively, the firm's payment ratio will be less profitable projects because of financial constraints and will indicate the availability of cash out of free cash flow and increasing efficiency, a certain level of access to external finance firms provided that it is limited.

This argument formed where these firms can get debt market availability of debt assumed. internally generated funds to try to raise the level. Not only the size but also the firm's capital structure affects the dividend decision. (1957) Darling firms with high debt ratios to meet possible claims for compensation for allowing argued that more liquidity is needed. Levering the manufacturer's gains plus curiosity for non-cost of debts due to put the manufacturer in danger of bankruptcy and a negative affect on the company's liquid role. To be had for a feasible dividend cost of interest payment of the enterprise's money glide, excessive debt ratio, which reduces gains profit (Rozef, 1982) of the organizations. Meanwhile, the profit of the dividend payment is considered among the determinants. In his classic study, Lintner (1956) and DeAngelo et changes in a firm's net income margin found that the main factor. (1992), except during periods of the current income managers are reluctant to reduce the dividend payment because earnings are very poor when the dividend is an important element of the decision argued that (Mayers & Frank., 2008). Fama and French (2002) also reported that more profitable firms pay more dividends.

Since Pakistan's corporate ownership structure and the economic scenario seems important to highlight some of the features that affect corporate dividend behavior is taken as a key variable. Pakistan Pakistan's majority shareholders of the corporations maintain control of the company, not only (Ibrahim, 2005) are engaged in the management of the Anglo-American dispersed ownership structure is the focus of the family-owned, dominate Is. Generally, companies mainly because of limited access to external capital markets are small in size. This potentially could reduce the company's property management In addition, management is reluctant to use equity financing. have been. If less than 20% but 10% of the shares of the company shareholders for the appointment of inspectors to investigate the affairs of the Security and Exchange Commission of Pakistan (SECP) can apply. Less than 10 percent of the shareholders or SECP (Ibrahim, 2005) can not apply. Furthermore, the corporate tax rate from 10% to negative profits are taxed at the source and companies, which makes them subject double taxation of dividend income are taxed at the rate of 35% from the profit of small investors prefer affects. Result of capital gains dividends more attractive for investors as it seems, while capital gains are exempt from tax.

Furthermore, Pakistan Pakistan's economy, gross domestic product (GDP) and increased equity market indices recorded in the last 6 years, according to the Economic Survey of Pakistan 2007-08 to 2007. The best performers in the South Asian region were among economies. Year 2007, GDP grew 6.9 percent but 5.8 percent in 2008. The US refused again broke a series of records and calendar year 2007 (the Economic Survey of Pakistan in emerging markets become the sixth best performer has been in the 2007- 08). KSE-100 index stood at 1,366.44 at 2001 and the period under study (2005 to 2007) General term for companies in the high growth opportunities that can be concluded on 14 December 2007., at 075.83.

Dividend empirical results on the effects on behavior are the result of firm-specific characteristics. The present study developed economies like the US and UK companies have focused on the conduct of the dividend, but the evidence is very limited form of emerging economies. Pakistan recently Job (2005) and Ahmad and donation (2009) studied the determinants of dividend policy in the context of the dividend policy of the two studies as a possible factor is argued by many researchers in the Cash flow side, did not consider (see DeAngelo and DeAngelo, 2006;), for example Lawson, for 1996. Moreover, the ownership structure of the companies paying the evidence is very limited effects. Therefore, the present study the effects of corporate payment cash flow and ownership structure by examining the literature trying to expand.

The present study used as determinants of dividend payments for the last variable is different from the study. Dividend payments on the impact of ownership structure behavior management and individual ownership, to be further analyzed and behavioral determinants of cash flow sensitivity and dividend payments as long as the operating cash flow in the context of the study are to be. Therefore, this study dividend of companies in the emerging economies of Pakistan and their behavior is an attempt to explore the impact of corporate characteristics. The results of this study trends and determinants of dividend policy and will provide an insight into the dynamics that are expected..

## 1.1 Background

In Pakistani taxation structure dividend is withheld from the capital benefit. Ownership formation, monetary corporations and liquidity situation play an imperative position to conclude the position of dividend. Jensen's (1986) concluded that company invest first worthwhile undertaking and makes use of their assets and paid the dividend out of residual. In step with firms point of view that cash generated from the operation of companies, operation play vital function to determine the quantity payment, firm have greater cash go with the flow from the operation and expected better position to pay dividend rather than firms had negative operation cash drift. prior observe suggested that high cash waft or financially firm lower back the excessive cash earning at some stage in the duration, when organization cant no longer raise funds from the outside market , which means that liquidity is most essential and liquid resources to investing in destiny profitable tasks.

## 1.2 Research Objective

This study examines to Identify different factors that are affecting dividend policy of any corporation and check their impact on dividend policy. Check impact of specific factors like cash flow ownership capital on best 30 companies of Pakistan that are listed in Karachi Stock Exchange (KSE 30 Index).

## 1.3 Purpose of the Study

The purpose of study to examine the dynamic and determinant policy of 30 companies which are listed in Karachi Stock Exchange (KSE) from the year 2004 to 2014, The reason of observe to take a look at the dynamic and determinant coverage of 30 organizations which indexed in KSE from the period of 2004 to 2014, in this study we use Lintner dividend modal 1956, we also use (OLS) Ordinary least square regression , wherein we discuss on ,managerial, individual ownership , coins drift sensitivity, length and leverage , to look at on effect of cash glide and possession shape on corporate payout, we additionally discover the possession structure , coins float sensitivity and running cash flow on dividend payout conduct of organization in emerging economic system of Pakistan, impacts unmistakable decision In Pakistan , no matter the importance of the marketplace in segment and the states non slandered tax machine, this have a look at targets to make available detail evidence regarding this problem through examining the perspectives of those stimulating with choice in observe.

## 1.4 Justifications/Significance of Research work

Dividend payout policy is one of the most imperative factors for corporate sector and their regulating authorities to sustain investment in any country. In Pakistan there are few firms that are properly facilitating investors through their dividend policy; here corporate sector is not aware of importance of dividend policy in long term. So, there is immense need of research in this area, to explore factors effecting dividend policy and also managerial views about current set up.

## 2.1 Literature Review

In the company finance debates dispute troubles are mainly usually within the dividend coverage in developed and gifted market. Several student / scholars try to determine hassle about concert of the determinant & energetic of dividend coverage, but we immobile accomplish no longer complete nice rationalization designed for the sensible dividend performance of businesses. One of the sparkling identified illuminations of dividend concert is the extent of employer's dividend among observe to increase and earning. In this studies Lintner (1956) find out those firms inside the United state (US) adjusts their dividend proficiently to maintain a goal prolonged tear payout ratio. Many research end up seen at the back of this attempt and authentication dispute to assist the dividend coverage corporations deviate beginning state to us of a unpaid quite number companies and principal market variation. In middle 1950s Lintner tiled a numeral of dividend guidelines, which were the result of his interviews through business manger. Initial of them, companies are mainly disturbed with the immovability of dividends, pursued with earnings which were pleased as the majority significant determinant of several adjust in dividends. Third, in the entire the monetary pronouncement result are in use in pursuance of dividend policy. Lintner's examination of empirical model of dividend policy came into viewed comparatively high-quality illumination 85 % percentage of the dividend modified in the taster of firms.

In company finance debate issues most frequently within dividend exposure developed and talented market. Several pupil / Scholars try to determine problem regarding overall recital of the determinant and energetic of dividend insurance, but we nonetheless accomplish now not complete first-class explanation sensible dividend overall routine of organizations. In sparkling identified amplifications of dividend concert extent agency's dividend through observe to enlargement and producing. Lintner's (1956) discover that businesses in united state (US) modify their dividend properly to sustain try extensive hasten payout ratio. Severa study emerge as noticeable after this attempt & authentication argued to assist dividend coverage corporations deviate beginning state to state amateur to quite number agencies and principal promote divergence. Lintner (1956) was earliest to examine the incomplete modification model of dividends. Model advice that revolutionize dividend is an occupation intention payment payout a reduced amount of the last episode dividend payout multiply through the rapidity of an alteration aspect. The objective dividend payout is a small part of the near era income. Lintner originate mainstream imperative determinant of company's dividend pronouncement was a most important revolutionize in paycheck "absent stripe" through accessible payment charges. Since a lot of mangers consider with the purpose of shareholders have a preference a stable tributary of dividends, companies be inclined to formulate episodic incomplete alteration towards an objective payment ratios quite than spectacular modify in payout. Consequently, mangers level dividends within the little sprint to keep away from numerous changes. Lintner experienced his intention and originate that the partial adjustment model predicated dividend payments additional precisely than "inexperienced" models. Within actuality, he originate with the intention of the model make clear 85% of revolutionize in dividends for his illustration of firms.

Miller and Modigliani (1961) measured the same as the pioneer during playing field. Their irrelevance theorem declared with the intention of the company's dividend policy is disparate to its present market assessment. Figures of researchers on the other hand do not have the same opinion with them due to their statement of ideal capital market.

Fama & Babiak (1968) and Fama (1974) discovered numerous in addition models for amplification dividend overall performance, their outcome preserve lintner's exam with the purpose of the managers have a desire a regular dividend coverage, and are unenthusiastic to augment dividends to a top with the reason of can not be endured. for this reason, those researchers done that modifies in for each proportion dividends are mainly a meeting of a goal dividend payout supported on profits and the closing generation dividend coverage. A complete examination of the significant performance of Lintner model was prepared through fama and babiak (1968) and the lintner's model was hardened, empirically, among their own Numbers or data and method. The outcome acquired through Fama and Babiak (1968) discover that Lintner Model was performing reasonable except declared to facilitate the model obtainable through lintner might be enhanced additional through establishing a further variables; the earning preserve from the procedure of last year, except lacking steady term, which they consideration, would improve its efficiency.

Black (1976) elevates the question "Why do firms pay dividends" extra he increase a 2d query "Why do investor pay attention to dividend" whilst the reply would possibly come into examination comprehensible, other than the black convey to a near with the aim of they are now not. due to the fact we try to explain the reality, the additional it gives the impressions harking back to puzzles, via part of a set that at once do now not wholesome together. a diffusion of elements be capable of be painstaking for the reason that determinant of price payout coverage in addition to a parent of judgment for dividend payout policy encompass be confirmed inside the literature; even though the researchers are not agreed on a solitary factor.

Melding and Jensen et al.,(1976) had been paying attention at enterprise outlay and suggested in their reports that dividend contain price range underneath control power, therefore situate beneath brutal principal market examination, further more decrease owner duty address prevalence of hypothesis to maneuver the costs on manger fundamentals. In addition they had been recommended that the supervisor's interest had been bringing greater stranger shareholder employer which used as device for scheming the difficulty of the firm. It will increase the association among the executives of the possession and dividend payout ratios. David and Jensen (1976) had been argued that the directorial shareholder ought to minimize the problem of the organization.

According to Jensen and Mechling (1976), and Jensen (1986) & Stulz (1988), economic leverage has a good sized duty in scrutinizing managers therefore plummeting organization cost happening starting off the investor mangers disagreement. active, deterministic variables, dynamic of dividend payout coverage further to practices of 320 non economic agencies, which were listed in Karachi inventory trade (KSE) at some stage in the age 2001 to 2006, those had been scrutinized via Hafeez and Attiya (2009) with concern the comprehensive Lintner (1956) model. The effect of exploration via Hafeez and Attaya (2009) scrutinized that non economic businesses scheduled via Karachi stock exchange (KSE), receive the guideline of depending not merely upon present income according to share apart from as properly beforehand pas dividend according to percentage fees. Hafeez and Attiya (2009) extra descript the result of the board regression executed to scrutinize the dividend payout manner that dividends be willing to be supplementary involved to give earrings subsequently preceding profits. a number of supplementary company practices, experiential and renowned via Hafeez and Attiya (2009) were that corporation amongst steady stream float of coins and performance pay extra and advanced dividends further to that possession arrangement plus market liquidity demonstrates having optimistic impact mendacity on dividend payout policy further to perform, although the available speculation opportunities as well as leverage have the other impacts on dividend payout ratios.

Rozeff similarly counseled that the ratio of optimum dividend had been decided elements, outside proportion holder financing transaction of fee and loose coins float cost of agency, Managers Self serving gadget have been manipulate the cash go with the flow and decreasing the fee of dividend also lowering business enterprise fee. The payment of dividend ought to theme supervisor's take a look at of out of doors capital presents and supervisor provide the monitoring device. Further he become recommended to facilitate the outdoor investor had been force to control remunerated the dividend to outside shareholder might require payout ratio decrease the operation and fee of the organization.

Rozef (1982) argued dividend have enough money approximately gain arrange wherein energetic monitoring agency management using its investor is omitted. Dividend is capable of probably improve this complexity restrictive the price range underneath executives manage and energy management the principal market extra commonly for ahead of budget, consequently placing them under the excessive examination of finances contractor inside outside capital marketplace.

The unenthusiastic involvement of dividend & leverage was furthermore maintained through Rozeff (1982) who theorized to facilitate condition a company has advanced working furthermore monetary leverage, extra belongings reserved equivalent, the company will decide subordinate dividend payout procedure to subordinate its expenditure of outside financing. his discoveries were supported on his suggestion with the intention of the dividend payout is a drastically unenthusiastic purpose of companies precedent and predictable future enlargement rate of sales, a appreciably unenthusiastic purpose of its beta coefficient through the manipulates of monetary leverage, a momentous negative purpose of the entitlement of stock held by insiders, and appreciably positive purpose of the company's numeral of ordinary stock holders.

Rozeff (1982) & Easter Brook (1984) have been counseled that the organizational buyers could be lessen the fee and shareholder have been affected the employer, their dating is terrible that's associated with the payout ratios of the dividend. Meckling., (1976) and Gensen(1976) has suggested organization cost power possibly concerted if external increase their rights in the organization, power bring into line the consideration of the collectively investor and manager thru congress the mangers, very last holder of organization / company besides additional hand, this ultimate rights from side to side administration will give enlargement to narrative conflict of

Reba (interest) a few of the Internal and externals, as executives dedication try accumulate supplementary price range underneath manipulate moreover via reducing the dividend charge before thru perpetuation price close to ground extent. Moreover patron's impact version recommended that the investor are worried at the direction of the firm whose fee coverage most super matching set their hypothesis, goals as investor countenance assorted tax behavior at the price and resources boom and convey upon yourself charge at the same time as they exchange securities.

Easterbrook's (1984) were arguing that repayment of dividend stay behind the corporations in principal marketplace anyplace looking at is much less expensive and is likewise decreasing the peak of hazard to invest according to their insist. Mayer (1984) suggested element organization pursue the series in consumption of belongings for speculation, in particular preserved profits are worn which generally is a smaller amount steeply-priced beginning vicinity of money pursued thru debt and fairness as the assets of budget..

Myers (1984) suggested supervisor used to be pecking orders which have retained incomes, debt financing and fairness, and that they have terrible dating amongst profitability and debt ratio. Haugen and Senbet (1986) recommended an group have a excessive tax liabilities are anticipated to perform the giant amount of debt take improvement of deducted interest of expenditures. Zimmerman (1983) prompt Taxes ratio is paid as pre-tax sales through hiring as a tax charge alternative. DeAngelo and Masulis (1980) informed non debt, taxes are deducted from substitutes which might be look after acquire of debt. Titan and Wessels (1988) instructed the ratios of depreciation, funding tax credit and tax loss bring onward to the total property. Capital structure evaluation takes concerned with monetary credit score score is the hazard of chapter. The debt ratio is the characteristic of the organization's vigorous performance at some point of time.

Jensen (1986) grew to be prompt that Manger did not pay the dividend at the same time the external shareholder might now not force. Many reviews had been completed, nonetheless however effect may be very prone main issue. Organizational investor's forecasting is to scale down the free rider troubles as a case of person / single possession Pound & Zekhouser (1990) had been recommended huge shareholder along side an organizational percent holder didn't tracking the supervisor right away but instead force them for paid the dividend.

Vishy (1986) had been advised that the block holder and dividend or some other type of the supervising. Supervisor activities had been reducing the fee of agency. Vishy & Shleifer (1986) were urged that the dividend and block holder are the 2d form of the monitoring. Rozeff (1982) have been suggested a variation, model had been implemented and get the effect that the dividend did no longer minimize the transaction cost. In Pakistan there are few gigantic households have a commercial organization. These giant households trade is cognizance on the company field, it is observed that these enterprise is define as block holder , block holder business company have their own directors, which lessen the rate of the company additionally cut back the effort through relationship between manipulate and block holder. Baker and farrelly (1988) assertion identical effect for dividend success, which they identify as businesses having an uninterrupted documentation of at the least ten successive years of dividend augments, farelly and Baker (1989) also carried out an examination of institutional traders. Their outcome exhibit that these tricky buyers consider with the intention of the person coverage influences the inventory costs and to facilitate, in procession through lintner's behavioral model, dividend reliability is totally giant. Titman and Wessels (1988) have been suggested that giant organizations are better shifted and lessen the preceding financial experience. Petit and Singer (1985) had been recommended the forecasting the fee of a chapter as percent to fee the company and talents created maximum facts roughly the themselves as review to the small businesses these announcements facilitate to the external shareholder as compare to the small organization / company. As compare to the growing companies and none establishing organizations, a develop companies had want additional outside monetary shareholders. Pecking order thought is described that a growing companies need to have first off generated the price range and secondly is debit financing. In accordance the rate minimizing variation, upward firms will advantage supplementary stranger financing. Hamada (1972) have been recommended that the leverage had been improved the cash glide potential of the organization external shock. Rozeff (1982) had been recommended that the company have a extra explosive cash waft normally need of outsider financing. Ozkan & Ozkan (2004) had been told increased leverage and cash cut down the cost. Parsouraitis (1989) scrutinized the experimental data of the Greek business enterprise's dividend insurance policies & efficiency by way of be correct the covariance which used to be supported on the examiner effort by means of Britain (1964) duvet 25 organizations throughout the technology of 1974 to 1983. Afterward, Joannos and Filippas (1997) appraised the dividend fee performs of 34 trade businesses chronicled by way of Athens stock alternate (ASE) for the era 1972 to 1988, the effects of which facilitated to demonstrate usual finale with the intention of the dividend coverage of the Greek companies reproduced the Lintner's model. The dividend fee perform opening the gift 12 months earnings incorporate probably the most associated and large variables which motives the changes in the dividend although dividend fee perform and guidelines of the firms are also manipulates through the prior dividend paying technology. Bond and Mougoue (1991) scrutinized whether the rapidity of modification and objective dividend payout rates oblique within the partial adjustment model are a precise classification of company dividend policy. They support their empirical examinations on 430 Unite State (US) industrialized companies coverage positive incomes and having remunerated dividends each year in excess of the 1968 to 1987 era. They originate that two possible troubles subsist while using the partial adjustment model to differentiated the dividend policy of the entity company. The earliest of these is that soaring quantity of association among the independent variables of the incomplete adjustment model may possibly have an effect on the experiential outcome of such models. The second possible trouble is that auto connected incomes of companies manufacture numerous mixtures of target rates and alacrity of adjustment that will fabricate the identical tributary of cash dividend in excess of time. Bond and Mougoue bring to a close that the partial adjustment model does not produce exclusive measures of the dividend policy of the single company. Numerous examinations afford impending interested in what aspects monetary mangers well thought-out most significant in determinant their companies dividend policy. Baker, farrelly, and Edelman (1985) and in 1986, studied 562

(NYSE) New York Stock Exchange companies among ordinary types of dividend policies in 1983. Supported on their examination of 318 answers from manufacturing, utility, and retail / wholesale companies, they originate that the main determinants of dividend costs were the expected the stage future income and prototype of precedent dividends. They accomplished that these issues demonstrated small modify from individuals indentifies through lintner (1956) in his behavioral model of dividends. The evidence also shows that the mangers were highly dividend continuity and believed that the dividend policy affects shares value. Furthermore, the result suggests that utilities have a somewhat different view towards dividend policy than manufacturing and wholesale/ retail companies.

Pruitt and Gitman (1991) inspected monetary managers of the one thousand (1000) major United State (US) companies regarding the relationship among the asset, financing and payment decisions in their companies. Their verification recommend to facilitate significant manipulates on the quantity of dividend remunerated are present year and previous year's profits, the year to year unpredictability of earning, and the increase in earnings. Pruitt and Gitman also originate with the intention of prior year's dividends are significant manipulates on present dividends. This result is entirely reliable among lintner's (1956) Behavioral model and the study effort of baker, farrelly, and Edelman (1985), above same scholar in 1986 in use jointly, these result argue that the respondents effort to preserve a elevated extent of reliability in the height of their companies dividends. In accumulation, Pruitt and Gitman originate managers build the dividend result offensively of the company's reserves and financing pronouncement. Mookerjee (1992) renowned that dividend announcement is well thought-out so significant that several corporations are listening carefully through rule to disburse dividends, still although from side to side outside finances. Nakamura (1985) observed that the Indian companies have the carry out of paying dividend through borrowing commencing banks; at support financially rate, than on or after their own profit.

Rajan and Zingales (1995) discover comparable altitudes of influence transversely the countries together through members of G7 association, prominence the thought that countries through depository sloping economies are supplementary leveraged than individuals within the market leaning ones. But, they documented with the intention of this difference is beneficial in investigated the assortment of foundation of financing. They discover that combined leverage is approximately indistinguishable transversely these counties. A little segment of Chinese companies was, empirically examined ahead through Huang & Song (2005) to prove the occurrence with the intention of the monetary leverage was associated through conservative variables, influential the capital arrangement of the firms. Their assessment confirmed the preceding consequence on or after the an assortment of researchers that leverage was positively associated among the amount of the company and the predetermined corporeal assets to the company and moderately interrelated among possibility along with non debt tax shelters, practical through the companies though the consequences examination of the Chinese firms furthermore revealed a optimistic association in the midst of the leverage and the unpredictability of the reserve. It was originate with the intention of replacement Chinese companies had, considerably, subordinate extended term debt. Huang and Song (2005) as a final point, mentioned to facilitate stagnant do business trade-off model afforded a sensible description of the capital configuration of substitute Chinese firms as evaluated to the pecking arrange suggestion in addition to that whereas the ownership organization is present to influence the capital arrangement, as renowned through the Jensen and Meckling (1976) the insignificant shareholding in china cannot be predictable to have a large amount consequence.

Vasiliou and Eriotis (2003) examined the involvement of the dividend policy among debt quotient. The examination was executed through consider a model with the intention of acquaintances the business dividend per share. The regression outcomes recommend with the aim of there is a positive connection among the dividend policy and the explored variables for the preponderance of companies scheduled on the (ASE) Athens Stock Exchange for the era 1996 to 2001. Vasiliou and Eriotis (2003) examined the involvement of the dividend policy among debt quotient. The examination was executed through consider a model with the intention of acquaintances the business dividend per share. The regression outcomes recommend with the aim of there is a positive connection among the dividend policy and the explored variables for the preponderance of companies scheduled on the (ASE) Athens Stock Exchange for the era 1996 to 2001. DeAngelo et al. (2004) pragmatic considerable relationship among the dividend payment pronouncement and the ratios of received capital to whole scheming assets, size of the company, leverage & cash in hand & preceding dividend payment olden times. The dividend payment has a concealed management viewpoint as through the conservation of the profits, augments the money mangers manage leading the preserve income which may be practical for improved speculation prospects except may possibly be also be expend exclusive of any appropriate monitoring performance of firms, afford the height of the influence is towering, which way that the speculation in the company is negative collision of influence leading the dividend payment recognized through Higgins (1972) and McCabe (1979) who discovered that firms who have a precedent elevated leverage usually disburse subordinate dividend to evade the advanced cost of heaving outside capital for the firm.

DeAngelo et al. (2004) pragmatic considerable relationship among the dividend payment pronouncement and the ratios of received capital to whole scheming assets, size of the company, leverage & cash in hand & preceding dividend payment olden times. The dividend payment has a concealed management viewpoint as through the conservation of the profits, augments the money mangers manage leading the preserve income which may be practical for improved speculation prospects except may possibly be also be expend exclusive of any appropriate monitoring performance of firms, afford the height of the influence is towering, which way that the speculation in the company is negative collision of influence leading the dividend payment recognized through Higgins (1972) and

McCabe (1979) who discovered that firms who have a precedent elevated leverage usually disburse subordinate dividend to evade the advanced cost of heaving outside capital for the firm.

courageous et.al (2005) take 384 govt interview from public to private groups, he took survey and gave the thought that each one government of the firms observe the Lintner 1956 modal and paid the dividend, in line with Lintner shareholder are greater interested in the dividend according to share of organisation overall performance, while, Ayub (2005) studied on dividend payout in economic system of Pakistan, he took one hundred eighty executive interview from more than one companies, which can be indexed in KSE from the 1981 to 2002 and were given result that there are simplest 23% earnings shifted within the dividend, last income company invested for corporation increase, there are many shares preserve organization director for high dividend and stand-in low finances. Ahmed & Attiya (2009) worked on the dividend policy of growing financial system like Pakistan, they took 320 corporations in pattern, which might be listed in KSE from 2001 to 2009, to start with they work on the Lintner, Fama, and Babiak models, and adjusted as partial adjustment modal and extensively utilized the regression evaluation, deliver the end result that in general Pakistani firms restore their past dividend charge believe on present day earning, 2d they say that most companies unchanging fine par incomes and analyses motive of dividend payout, additionally that marketplace liquidity and possession are truly connected with dividend payout ratio, but no longer impact on effect on size of company, dividend fee and to located depressingly related to payout.

In the establishing of the twenty first century courageous at Al (2005) converted into finished a experiences on the dividend payout policy. The study receives the 384 non-public interviews from the private and public govt of the fiscal enterprises. He went to the sphere, takes survey and argued that the lots of the govt of the corporations had been fallow the linter's (1956) variant at the same time they may be determined the dividend payments. McCluskey et al (2007) were recommended that the investor could see the dividends and incomes of the manufacturer, nevertheless the predominant wide variety is incomes of the company. Inside the postal survey of the unites country (US) 562 businesses Baker at el (1985) had been located that the 86% Parentage of the respondent of the enterprise determinant on future earning, and sixty six% percentage have been say the past incomes of the organization dividend, however the genuine story is incomes of the company and dividend is the marginal sign.

Fama and French (2002) had been validated the Pecking Order concept and alternate Off notion, they have been concluded that greater gainful corporations have sophisticated dividend payouts, organizations thru additional funding have inferior payouts and the connection amongst leverage and cost in dangerous. Gordon and Walter (1985) was once furnished the chook in Hand concept and steered that shareholder need money in hand than manageable capacity predictable income.

Rao and Lukose (2003) deliberated the capital arrangement determinants of non monetary (Financial) corporations of India earlier than as well as throughout the liberalization of monetary markets during 1997 & cross sectional assessment of the market & book significance leverage were considered ahead on behalf of the era preceding 1990 to 1992 furthermore placement 1997 to 1999 relaxation era among the facilitate of predictable illustrative unpredictable's, such as physical assets model, size, growth rate and profitability. The major objectives were familial multinationals, overseas corporations were, inversely, interrelated among the leverage except the manufacturing imitation variables were not demonstrate noteworthy.

Dhanani (2005) have been done a survey and used certain methodologies within the reports, he took secondary files from economic and non fiscal organizations. The documents were amassed from pinnacle 800 corporations which had been listed inside the London stock trade (LSE). The survey outcomes opted to scrutinize empirically the value and importance of a ramification of hypothesis of dividend in Unite nation (uk) corporations and to check the diploma to which these theories are influences through manufacturer characteristics of length and enterprise sectors. The effect suggests that the united kingdom (uk) firms Mangers guide the total dividend significance inspiration; corporations commonly disprove the wonderful dividend for hypothesis selections. And additionally don't forget with the aim of the dividend pronouncement tolerate incomplete flexibility amongst which to manipulates capital structure pronouncement that's within streak signaling concept.

Supplementary not too long ago in Pakistan historic past, Attiya and Ahmed (2009) had been take a appear at determining limitation of dividend process in promising fiscal approach of Pakistan mendacity on a instance of 320 businesses which had been listed in the Karachi inventory trade (KSE) from 2001 to 2006. To start with, they realize Fama, Lintner and Babiak projected variant. Which had been the conservatory of incomplete change mannequin using board regression and establish that Pakistani companies rely larger on present gains and precedent dividend participate in restore their dividend imbursement, Secondly, they verified the determinants of cost expenditure and originate that businesses by way of unwavering confident internet incomes pay larger dividends. Furthermore, the possession attentiveness and market liquidity are absolutely related by way of dividend disbursement ratio apart from boom movements had no bang on dividend imbursement and size of the organizations installed to be unenthusiastic and significantly related via payouts.

Study of the Ayub (2005) and the studies of the Attiya and Ahmed (2009) were examined the baseline of the appear at. Ayub (2005) were listening cautiously at the duty of business ascendancy associated factors is conniving dividend policy, while, Attiya and Ahmed (2009) had been examined the collision of now not wonderful industrial typescript on dividend payout. Although, money pursue which is comparatively additional good sized than supplementary profitability became no longer measured thru together study. Ayub (2005) have been advised that amplified possession by means of managers broaden the enterprise dividend payouts, although, in Pakistan someplace preponderance of companies have concertinaed own family possession constitution and enterprise perform are usually not powerfully supervised, executive, to tour around the force of possession structure, money observe compassion and in cost money movement on dividend payout performance of businesses in rising fiscal device (monetary process) of Pakistani.

In a couple of approaches we are competent to outline leverage, Rajan and Zingales (1995) told that goal analysis depend on the leverage, in the research of the capital structure organization main issue described as debit to company's value ratios. Debt is split in

multiple components, numerator and denominator. Debt defines as debt to normal property, debt to net belongings, debt to capitalization. Debt to capital is degree in empirical reports of leverage. In the founded variables we use 3 measure of leverage, very long time debt to complete belongings, quick term debt to overall property, basic debt to whole property ratio. Titman and Wessels (1988), Pandey (2000) and Chung (1993) also use unusual measure of leverage.

Jensen, Solberg, and Zorn (1992) recommended that dividend rate and debt act both are shrink the company value, and that they've inverse relationship. Myers (1977) identified the growth prospects within the determinant of capital structure. Several revise and suggested debt coverage will also be plagued by the scale of the manufacturer, and that they have constructive relationship between organisation's size and debt ratio.

The times assortment goes sectional methods (TSCS) is engaged to investigation the information and have a look at the collision of trade organization cost at the debt insurance policy of company. TSCS embody the mechanism compact each and every the international lively and the distinctiveness of agency being investigated, go sectional regression makes use of the common worth of every variables. Smith and Watts (1992) steered throughout the industries stage grouping notably founded on two digits SIC codes is employed to scale back the dimensions error of variable. Hsiao (1986) counseled organization version pleasurable the hypothesis of ordinary intercept and to permit intercept method represent personality enterprise have an impact on, on the grounds that numerous corporation organization have a blended outcome in prior study. Tailed t-verify are used to test the foremost regression coefficient for every one variables. at some point of the previous fifty years the several empirical and theoretical research are finished most important to the in general 3 conclusions, the increase (diminish) is dividend payout influence the marketplace ethics of the organisation or the dividend coverage of the corporation does no longer have an effect on the company morals at every single one. even though, we field articulate with the purpose of the empirical confirmation resting at the determinant of the price (dividend) policy is regrettably extremely assorted. Modigliani & Miller (1961) were argued that in ideal market, dividend could not have an effect on the corporation's performance. Shareholder of the firm now not afflicted their coins flow

Due to the fact dividend is the shape of the important grows, so the employer could not alternate their funding policy. on this kind of the circumstances business enterprise dividend payout ratio impacts their ultimate complimentary coins flow and the consequence is after the coins glide is constructive (high-quality) agency's come to a decision to pay dividend & if unenthusiastic (bad) business enterprise's come to a choice to trouble the stocks. they're also concluding that the misrepresented inside the dividend is probably transmission them in series to promote regarding organisation's capability take-home pay. chicken in hand concept had been gift by means of the Walter and Gordon in (1983), the theory say that shareholder forever like higher the cash in dispense (hand) relatively than a expectations (destiny) undertake of most important benefit fantastic to reduce the risk. Meckling and Jensen (1976) had been present the corporation theory, the principle supported at the divergence a number of the investor and manager and the entitlement of impartiality managed by means of the internal ownership be supposed to control dividend coverage. Easterbrook argued about the business enterprise price troubles at hand there are two outward appearance of the corporation value; first is fee tracking and 2d one is the fee of the threat which can be given through the managers or directors of the corporation. Baker and Wurgler (2004) have been given the catering principle, the writer argued that managers in set up to offer inducement to the investor with paying level dividend at the same time as the investor situate inventory charge payment on payers with not paying after buyers have a preference non payers.

Linter (1956), Fama and Blahnik (1968), D Souza (1999) have been discovered the negative organization a few of the corporation rate and effective (residual) chance in the midst of dividend payout. Although, the result accomplish not preserve the unenthusiastic organization among the funding occasion similarly to dividend payout guiding principle. DeAngelo et al (2004) were documented extremely important involvement most of the finish to disburse dividend and the ratios of be paid impartiality to normal equity scheming for the dimensions of business enterprise, success, augmentation, leverage, coins equilibrium and olden occasions of dividend. Additional, the dividend imbursement hold faraway from central company crisis in view of the truth that the upkeep of the incomes offers the manager's control further than yet another admittance to developed speculation occasion and without some tracking. Eriotis (2005) had been stated that the Greek businesses distribute their dividend every year agreement their intention payout ratios, which is determinant thru dispersed incomes wide variety of these manufacturer. Redy (2006) were performed study inside the India, he showcase that the dividend paying enterprise are further high-first-rate in length, rewarding and growing. In Indian context enterprise tax or tax wish thought does no longer carried out inside the Indian corporations. Megginson & Eje (2006) had been completed researched and found out that dividend paying propensity of 15 ecu businesses flip down tremendously bigger than their era 1989 to 2003. If the setting up of safeguard incomes to complete fairness executes now not augment, besides the organization age does. In addition they discover that the end result of food education the dividend methodically which isn't decisive affirmation of continent and big junction in dividend method. Reward is an awareness in appear into the dividend overall efficiency of the trade company in the back of the foreword of code of corporation ascendancy be SECP 2002 in Pakistan besides a whole lot of trouble this neighborhood are uncovered. In scrupulous, the crisis engages for determinant for / of dividend polices in Pakistan, that's center subject of the location standards in deepness reviews.

Li et al. (2006) pragmatic with the intention of the capital formation and the superiority of the monetary businesses depend main the capital vendors. With be appropriating the chinese statistical firms database of seven-hundred scheduled and 260,095 unlisted businesses li, Yue and Zhou (2006) scrutinized the affiliation among the assorted structures of leverage & the specific forte, such like, capital structure, organizational administration, macro and micro economics facet, with the intention of the chinese language organisations are totally managed via quick term debt, despite the fact that it was once moreover uncommon that ownership and organizational features economic records for concerning a third of the entirety dissimilarity in leverage ratios.

Mahagaonkar and Narayanan (2007) of their booklet used correctly possible least square approaches to broaden a variation of capital constitution for the manufacturing region of India which included the control mechanism for the trade company dimension, tax charge, money in hand, curiosity coverage, and profitability. Their evaluation moreover included the have an effect on of tenure of the organization on leverage with the support of interacting with each of the unbiased variables with dummy variables for the age and size as well. Size and the profitability had been proved to be most central determinant factors for the capital constitution for brand new agencies; size grew to become obviously whilst because the profitability was once inversely involving leverage.

Naeem and Nasr (2007) argued that the liquidity of the organisation flowers a downbeat impact taking place the company's dividend payout end result. The stock market liquidity as well as dividend is alternated inside the view of buyers, consequently the agency's dividend policy is related to the liquidity of its common stock, for the reason that effect companies among extra liquidity common stock distribute less cash dividend. From literature above, its miles clear that there may be no look at that used each qualitative and quantitative approach in this subject. There are few researchers that explore this area in Pakistan. Our examine is not best awareness on regression analysis but additionally on specialists evaluate about dividend policy.

## **2.1 The Capital Market of Pakistan**

Pakistan presently has three operational inventory markets, all of that have experienced high increase stages in cutting-edge years. The present seem at concentrates on the Karachi inventory alternate (KSE) as it is a ways the main change inside the U . S . A .. At the discontinue of 2010, there were 644 listed firms with a marketplace capitalization of Rs. Three, 269.Zero billion (\$38.17 billion)[3]. The KSE is without doubt one of the principal sources of information about listed businesses for Pakistani buyers and performs a key operate in preserving market discipline; as an example, it notifies the general public roughly defaulting corporations, which in flip effects in shares being de-indexed from the KSE. Every other cause for de-list – and probably the most methods wherein the Pakistan market affords an idiosyncratic environment for dividend-related research – is the failure of a moneymaking organization to assert a dividend (coins or percent) over a interval of 5 years from its last statement date. Similarly to this statutory requirement, the KSE problems an annual ranking of companies on the inspiration of “properly” performance. Each year, the trade identifies a record of the head 25 corporations on the foundation of their efficiency in exclusive regions, with the announcement of “colossal” dividends for shareholders representing probably the most carefully weighted determinant of the analysis. However, KSE documents indicate that a lot lower than 50 in step with cent of indexed corporations paid dividends in every of the years 2005-2009.

If you wish to offer some context for the interviewees' responses about the determinants of dividend insurance policy, the applicable statutory requisites about dividend disbursements in Pakistan (as outlined in the employer Ordinance 1984) had been clarified. In keeping with part 249 of the ordinance, “No dividend shall be paid by using a manufacturer in any other case than out of the revenue of the company.” section 248 states that “The manufacturer traditionally assembly might also claim dividends; but no dividend shall exceed the variety recommended through the directors.” regarding the cost of dividends, part 251 of the agency Ordinance notes that “[. . .] the chief govt of the enterprise can be dependable to make the cost [. . .] inside of forty-five days from the date of assertion of the dividend.” In observe, dividend insurance policy is decided upon at a board of directors (BoD) meeting main issue to the approval of the annual general meeting (AGM. The BoD makes a determination upon the dividend constant with share (DPS) (not the entire variety of dividend) as directed by the use of law.

Quantities of earlier research have investigated the dividend regulations of Pakistani companies (Nishat and Bilgrami, 1994; Naeem and Nasr, 2007; Ahmed and Javaid, 2009; Nishat and Irfan, 2001; Nishat, 1992; Kanwer, 2002; Kaleem and Salahuddin, 2006; Zaman, 2007; Mubarik, 2008). But, the empirical work contained therein employs various methodologies and arrives at designated conclusions. For example, Nishat and Bilgrami's (1994, p. 339) proof supported Lintner's variation, suggesting that “in Pakistan, ultimate 12 months's dividend cost and web profit after tax play a giant function within the gift dividend choice.” The authors used regression evaluation taking DPS as the based variable for a sample of 225 corporations indexed on the KSE over the size 1980-1986 and documented the existence of a partial adjustment approach as agencies moved to a brand new dividend payout stage. However, the compare concluded that there was obviously a broad form of identifiable impacts on payouts; as an example: “[. . .] large dimension firms, corporations with overseas possession and private quarter organizations declare bigger dividend payouts” (p. 344). A more current evaluate by way of Ahmed and Javaid (2009) documented that Pakistani firms most often found Lintner's version, using a regression variant with current dividend yield as the structured variable. Their penalties highlighted goal payout ratios opening from 25 to 39 per cent with enterprises taking from between 1.57 and a few.36 years to get to this target level. Nonetheless, the authors also commented that throughout Pakistan: “listed firms depend greater on current income than beyond dividends to restoration their dividend fees. In a similar fashion, Khalid (2010) mentioned revenue as being the important dividend determinant for KSE companies from 1988 to 2008, although previous payout ranges, firm size, reserve degrees and gearing ratios all had an influence, as did monetary liberalization (in encouraging organizations to hire equity financing).

In contrast to these study, Naeem and Nasr (2007) encouraged that trendy profitability grew to be not an predominant factor throughout the decision of Pakistani corporations' dividend ideas. The usage of a regression variant with payout ratio as the headquartered variable, they determined that excellent year's dividend became the highest influential thing on a group's latest-day dividend coverage. Furthermore, the authors documented a fine deal of variability and instability within the dividend repayments for the sample of 108 corporations indexed on the KSE over the period 1999-2004. Bigger not too long ago, Afza and Mirza (2010) analysed statistics for KSE companies from 2005 to 2007 and mentioned that, while gains does play a role, the primary factor determinants of dividends are possession form, coins glide and corporation size. What all the prior stories have in now not unique, but, is the aggregation of tremendous samples of numerical expertise; given the unique nature of a quantity of the foundations surrounding disbursements to shareholders in Pakistan and the contradictory nature of the findings, it's unexpected that little or no strive has been

made to talk about the dividend selection-making approach with those worried in observe; the gift take a look at is meant to care for this omission

**3. Methodology:** The current chapter exhibits the methodology adopted for the current study. It also briefly discussed the research design of the current study, the techniques used for sampling the date, procedure adopted for data collection and analysis of data.

### 3.1 Research Design

The current study is depended on secondary information. So, for investigation of proposed objectives study collected the information from the reports of companies which were published in the shape of audited financial statements like documentary, websites of companies and other secondary sources, etc. The study used ordinary least square (OLS) or regression to analysis or interpret the results.

### 3.2 Data Collection Method

Knowledge was once accumulated from Audited fiscal Statements and analysis of joint inventory businesses, which are listed on KSE. The period was once selected for this study was once 10 years effected from 2005-2014. The Study designated the thirty companies which are selected randomly. The reasons for selecting this proportion are the availability of time.

#### 3.2.1 Secondary Data

As above mentioned earlier the study is based on secondary information, so all the data was collected through companies, official websites, and documentary, published material of companies and through audited financial statements. Moreover, Study sets the variables and includes it in study. These variables are Net profit margin, Cash ratios, Quick acid test ratios, debt to equity ratios, ownership structure, Return on assets, financial leverage ratios and price earnings ratios. The Study collected all the data and then calculated all the variables according to their companies' formulas.

### 3.3 Sample Design

The random based sampling techniques are used to collect the data. The sample size for the current study is based on thirty companies out of 50 companies of Karachi Stock Exchange.

#### 3.3.1 Target Population

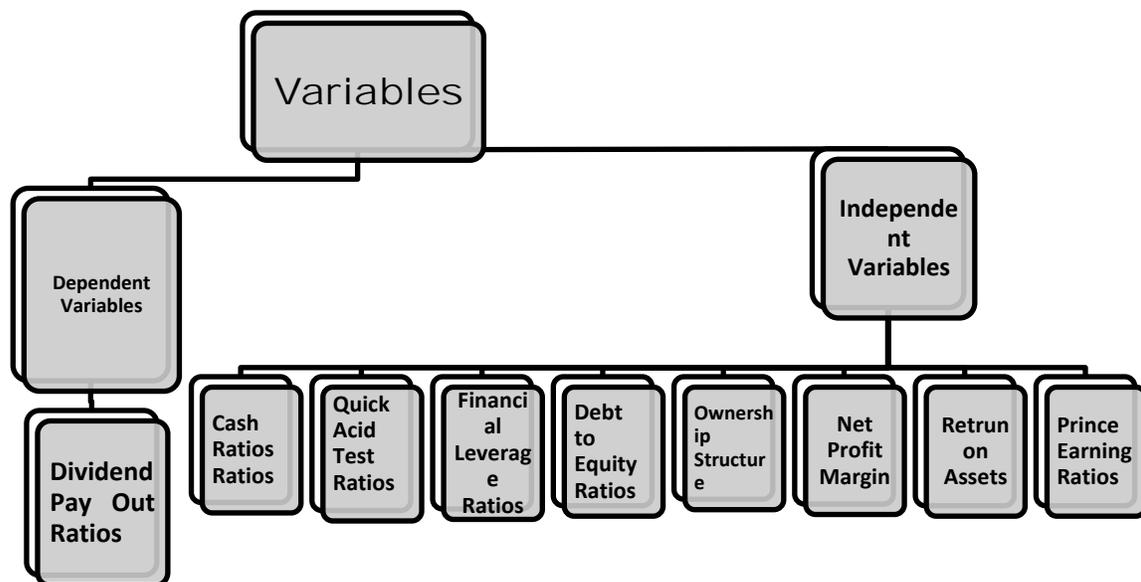
The target population of the study is four sectors. These four sectors are insurance companies, banking, investment banking and sugar industries.

#### 3.3.2 Sampling Size

On the base of four different sectors the sample size of the study is 30 companies. The study randomly selected thirty companies.

### 3.4 Theoretical Frame work

The theoretical framework for the study is shown in figure 3.1. The study measures the impact of corporate governance variables on financial performance of the firm.



## FIGURE NO 3.1

### 3.5.1 Variables

Following are the independent variables of this study;

#### **Dependent Variables:**

**Dividend Payout Ratios:** We are going to behavior a learn regarding dividends and it is miles as a result of essential value that we use the highest vital degree of dividend so that it is going to get an accurate effect. The 2 highest standard measures of dividends are the dividend payout ratio and the dividend yield. Both these methods provide nontoxic measurements, nonetheless they measures dividend expenses in exclusive ways. The dividend payout ratio is described as the proportion of the agency's profits that is disbursed to shareholders. As may also be seen throughout the method beneath, it simplest takes interior factors into problems and the dimension is for this reason impartial to outside causes (Penman, 2009 p.264). In evaluation to the dividend payout ratio, the dividend yield is influenced through outside motives due to the fact that it takes the stock fee into concentration (Warren et.Al 2011 p.685) chapter 3: Theoretical Framework 21 Many scholars have mentioned the diversities among these two measurements and each and every have advantages and drawbacks which may influence the effects of the have a appear at (Fama & French 1988) (Lamont 1998) (pal & Puckett 1964) (McManus et al 2004). Even though dividend payout ratio and dividend yield share the identical numerator in their formulation they take uncommon elements into consideration. Preceding study have found out that dividend yield and dividend payout ratio are extraordinarily specified and it can be a ways consequently predominant to decide on the maximum applicable size considering that it will have a major affect on the outcome. Traditionally McManus et.Al (2004) emphasizes the significance of dividend payout ratio over the dividend yield, as a result of the have an effect on of the previous in explaining the returns over the latter. In addition McManus et.Al have pin-pointed, that the signaling affect of dividend payout ratios is better informative as compared to dividend yields considering it first-rate accommodates inside service provider motives (McManus et.Al, 2004). Fama & French (1988) have on the opposite learned that the dividend yield has an capacity to count on the stock returns and it as a result furnish more records as compared to the dividend payout ratio, (Fama & French, 1988). Further, the dividend yield changes seeing that the inventory fee changes and the dimensions is as a consequence out of the group's manipulate because it takes market elements into attention (Steven & Jose, 1992). It is some distance hard to say which of the 2 measurements that is great considering that they provide an explanation for difference add-ons of dividends. Which size to select out depends thus at the intent of the study and the organization decided on elements blanketed within the study. If we wholly would have blanketed internal or external company determined on explanations it maybe delicate to justify the measurement of dividends. However with a purpose to encompass probably the most valuable measurements, we needed to include each interior and outside measurements. Without doubt now we have chosen to embody 4 inner elements and external which can be suffering from the inventory cost. Established on the supplier chosen factors and the differences between the two measurements now we have got chosen to use the dividend payout ratio within the study. Most men and women of the previous research have commonly utilized the dividend payout ratio (Rozeff 1982) (Lloyd 1985) (Amidu & Abor 2006).

#### **Independent Variables**

**Debt to Equity Ratio:** The debt-to-equity ratio is a economic ratio that suggests the relative percentage of fairness and debt used to finance a corporation's property. This ratio is likewise referred to as threat, gearing or leverage. Pruitt and Gitman recommend that danger influences organizations' dividend insurance plan. Organizations with high increase charges and high dividend payout ratios make use of debt financing and establishments with excessive leverage in assessment to their respective enterprise Dhillon, nevertheless, placed conflicting evidence for the connection among dividend payout ratios and leverage. In a few industries payout and leverage ratios are positively associated at the same time as in other industries the connection is dangerous. Rozeff , Lloyd et al. , and Collins et al .Learned statistically colossal and terrible courting between corporation's hazard and the dividend payout ratios. Their findings propose that companies having a greater stage of hazard will pay out dividends at diminish fee. D'Souza moreover finds statistically giant and bad relationship among threat and dividend payout.

**Cash Flow:** The cash float position of a corporation is an critical determinant of dividend payouts. A poor liquidity function approach much less generous dividend as a result of shortage of coins. Alli et al. Argues that dividend charges depend bigger on cash flows, which replicate the company's capacity to pay dividends, than on state-of-the-art-day profits, which can also be much less heavily influenced by way of accounting practices. They declare that modern day sales do not clearly replicate the firm's ability to pay dividends. Amidu and Abor [1] determined a high quality relationship between money waft and dividend payout ratios. Anil and Kapoor additionally point out that cash float is an foremost determinant of dividend payout ratio. Alli, Khan, Ramirez, & G (1993) explained that cash glide is further crucial determinant of dividend than profitability as cash waft examine the capability of the group to pay dividend. Authors argue that profitability do now not mirror the institution's capability to pay dividend.

Brook, Charlton, & Hendershott (1998) examined the connection of cash glide and dividend payout. Authors defined that growing coins flows are enormous determinants of dividends. The enterprises with developing coins glide have a greater tendency of saying dividends. Mohamed, et al. (2008) located a great relationship amongst dividend payout and dealing cash go with the flow constant with percentage in Malasia. Running cash drift consistent with percentage emerge as a full-dimension determinant of dividend payout of their have a appear at. Gill, Biger, & Tibrewala (2010) in their discover individuals capital market concluded that the relationship amongst money float and dividend payout ratio is bad for each production and supplier organization. Cash waft changed into a mere determinant of dividend payout ratio of their research.

**Current Ratios:** The current ratio is a financial ratio to facilitate measures whether or not otherwise not a organization has good enough capital / assets to pay its debts over the subsequent twelve months or in a single year. It evaluates manufacturer's modern day / gift property to its reward or present liabilities. The add-ons of the modern-day ratios is modern day ratios is same to contemporary belongings dived by the use of cutting-edge-day liabilities. Current ratio of a corporation's market liquidity and capability to satisfy the needs of lenders is a component. Suited cutting-edge ratios variety from industry to enterprise and health company is most likely among 1.5 and three. A company's present ratio is inside the style, it on the whole shows a short-time period economic power. If today's belongings exceed latest liabilities (contemporary ratio is below 1), the company's troubles can meet brief-time period obligations. If the state-of-the-art ratio is just too high, the organization rapid-time interval financing your modern day belongings or the use of the centers could not be effective. It's ready to moreover opt for out troubles in working Capital manage. Current or quick ratio (lower than 1 price) for the low values of a firm can occasionally meet cutting-edge obligations shows. Low values, however, do no longer advise a primary hassle. If the company is a perfect lengthy-time interval prospects, so that it will meet present day duties in opposition to their possibilities may be ready to borrow. A number of varieties of organisations probably operate with a low modern-day-day ratio. Money owed payable, stock a best deal larger fast turns into so much considering that, for illustration, the time could also be less than the modern ratio. A corporation with a low present day ratio can permit to work. Take into account the ratio will fall due within the following 12 months to satisfy its responsibilities. You cycle length of operation and the relationship amongst state-of-the-art ratio must be In finance.

**Acid test or quick ratio:** The acid experiment or fast ratio or liquidity ratio measures the ability of a organization or extinguish its present liabilities instantly to retire the money or assets to use immediately. Rapid property in most cases instantly shut their publication values that can be changed into money, together with present asset. With a speedy ratio of less than 1 time a enterprise's present liabilities should not totally paid, the system of the acid scan ratios is equal to money and cash equivalent plus Marketable securities plus debts receivable divided by means of present liabilities. Be aware that property in share to the amount of stock swiftly deleted, but the current ratio is incorporated. The proportions of corporations are validated for viability, but don't supply a whole image of the well being of the industry. Vital business expenses and bills payable as a result of (say a hundred and twenty days), and out of money. Companies increasingly from suppliers or consumers by way of paying money, and lengthy terms are negotiated in contrast; it's a little speedy ratio and still is healthy. Mainly, the acid test ratio will have to be 1: 1 or more, nevertheless, differ widely through industry. In most cases, the larger the ratio, the corporation's liquidity (i.e., the better equipped the present Use liquid property to meet duties.

**Price earnings ratio:** Incomes price progress ratio (the ratio of cost / profits) an evaluation, sales per share (EPS) relative trade-off between the price of a stock to examine the metric, and the organization's expected progress. By and large, P / E ratio of a manufacturer with a high progress cost is supplementary. That is hyped up relative to other high-growth firms will exhibit best the P / E ratio utilizing. The profits progress rate P / E ratio through dividing, leading to a ratio comparing firms with unique growth fee that is assumed to be better. PEG ratio is considered a easy approximation. Wall street after his 1989 work "says Peter Lynch, who, by the popular stock Market. It victorious investment in his 1969 e-book, A newbie's advisor Mario was developed by using Farina reasonable; the development price will probably be equal to the value 1 of the enterprise. The system is PEG is the same as cost dividend by using earnings is divided via Annual EPS progress. The augmentation expense is articulated while a persen incomes cost increase ratio (the ratio of cost / gains) an evaluation, sales per share (EPS) relative alternate-off between the fee of a inventory to come to a decision the metric, and the industry corporation's anticipated growth. In general, P / E ratio of a enterprise with a excessive growth fee is supplementary. That is overrated relative to unique high-boom corporations will exhibit only the P / E ratio the usage of. The profits boom cost P / E ratio via dividing, leading to a ratio evaluating businesses with one-of-a-sort develop rate that is assumed to be better. PEG ratio is viewed a simple approximation. Wall road after his 1989 artwork "says Peter Lynch, who, by way of the noted inventory marketplace. It a success funding in his 1969 e-book, A beginner's guide Mario was once advanced by making use of Farina fair; the broaden rate could be equal to the price 1 of the manufacturer. The approach

is PEG is equal to price dividend with the help of sales is split by way of Annual EPS expand. The augmentation rate is articulated even as a percent divided through 100%, further to have to utilize true expand in basic terms, to correct for inflation. For illustration, if an enterprise is upward at 30% an every year / yr, in genuine conditions, and has a cost incomes of 30, it might have a rate earning increase of 1. A reduce ratio is "elevated" & an increased ratio is "inferior" (highly-priced). The cost income ratio 2nd-hand throughout the computation is regularly predictable or rambling, and the every yr increase cost will also be the predictable development rate for the sooner or later three hundred and sixty five days or the next five years. Tage divided via one hundred%, in addition to should make use of legit development in basic terms, to correct for inflation. For illustration, if a corporation is upward at 30% an yearly / year, in respectable stipulations, and has a fee incomes of 30, it will have a price incomes growth of 1. A lower ratio is "increased" & an improved ratio is "inferior" (luxurious). The price earnings ratio second-hand within the computation might be predictable or rambling, and the once a year development rate will also be the predictable progress price for the subsequently yr or the subsequent 5 years.

**Financial leverage:** Leverage will broaden a corporation's money drift sensitivity to external shocks (Hamada, 1972). A company with bigger risky cash flows may also be normally in want of external financing (Rozeff, 1982). Moreover, a better leverage ratio reduces the probability that the enterprise will accumulate further outside financing with no trouble and cheaply (Ozkan and Ozkan, 2004). Consequently, it is miles hypothesized that each leverage and cash glide volatility are negatively concerning dividend payout ratio. We measure the financial leverage of a corporation by way of dividing normal debts through general property. Cash glide volatility is measured given that the coefficient of variation of internet profits and is represented by means of LEV and CV for that reason.

**Return on assets:** Return on assets (ROA) of an institution's property are in producing earnings that suggests how helpful fee. This quantity is organization, a couple of greenbacks of earnings derived from each buck of belongings they control how they're equipped to do with tells you. That is to compare organizations throughout the same industry competitors is a valuable variety. The form will range generally in great industries. Return on belongings relies on the enterprise in which the organisation offers an illustration of the value of the capital, require enormous preliminary investments by and large have low return on property of businesses. ROAs than 5% is almost always considered detailed.

**Ownership structure:** In his evaluate of organization costs and the dividend paying habits of companies, Rozeff (1982) argues that dividend expenses are a part of the organization's monitoring bonding package, in that businesses are inclined to pay out more in dividends when insiders very possess a cut back percentage of stocks. As in Rozeff, the variable representing inside possession on this model is the share of shares owned by way of insiders as mentioned via rate Line funding Survey. Measures of out of doors shareholder attention are also considered within the possession structure for the tracking role they are going to play. The first is the average log of the range of significant shareholders as urged with the aid of value Line. Rozeff argues that the extra the quantity of shareholders, the larger delicate the possession; due to this fact a poor or insignificant dating should be envisioned between the form of shareholders and the level of debt. The second one proxy represents the makeup of external possession and is protected to examine the Grier and Zychowicz (1994) guiding principle that institutional traders might also alternative for the disciplinary function of debt throughout the capital form. This variable is outlined as the percentage of shares owned via using institutional traders, additionally as mentioned by way of VaEue Line. Dividend fees service provider theorists have drawn a hyperlink between the issuance of debt and the cost of cash dividends (e.G., Jensen, Solberg, and Zorn, 1992). Above all, it's miles urged that dividend payments and debt act as substitutes in decreasing agency prices. Accordingly, dividend payout serves as an explanatory variable with an hypothesized inverse relationship.

**Growth:** A developing corporation is much more likely to require external financing than a non-establishing organization. In step with pecking order concept, developing corporations need to rely first on internally generated budget, debt financing need to be taken into consideration as a 2nd choice and therefore fairness must be mentioned this implies a terrible relationship among the many corporation's growth fee and its dividend payout ratio. Under the price minimization mannequin, developing businesses will preserve cut back dividend payout ratio due to the fact that they are considered riskier than additional mature and robust organizations and face better tran-saction prices of external financing. We have measured growth as geometric suggest of annual percentage develop in complete property and is represented via GROWMyers (1977) identifies expand opportunities as a enormous determinant of capital constitution, for which Rozeff (1982) makes use of rate Line's forecast of five-365 days earnings broaden as proxy. Since this verify represents an ex ante estimate of expand possibilities, it is also used within the version.

**Firm size :** Massive businesses are additional exclusive and far much less likely to ex-perience fiscal distress (Titman and Wessels, 1988), face scale back anticipated charges of economic spoil as a percentage of common organization worth, and generate more information approximately them than small businesses (Pettit and Singer, 1985). These factors facilitate giant firms' get right of entry to to external financing at a lessen price than small businesses. Within the value minimization version, retaining other concerns steady, significant establishments must have a better dividend payout ratio. Our degree of length of the corporation is represented with the support of measurement and is calculated as a log of total belongings.

### 3.5.3 Hypotheses

Following are the hypothesis of the study:

H1: There is positive effect of ownership capital on dividend policy

- H2: There is positive effect of cash flow and size on dividend polic
- H3. Positive impact of the good dividend policy on the share prices of the firm
- H4: Changing dividend policy in terms of investors view will positively effects firm’s performance in long term

**RESULTS AND DISCUSSIONS**

The current section of this chapter analyzes the data on the basis of regression model. This study find the following results of the thirty Two companies of Karachi Stock Exchange Pakistan, including Dividendt as a dependent variables. Independent variables includes board size, audit committee, annual general meetings and chief executive officer.

**Statistical Modal:**

**Simple Ordinary Least Square Modal:** In knowledge, ordinary least squares (OLS) or linear least squares is a process for estimating the unknown parameters in a linear regression variant, with the intention of minimizing the variants between the located responses in some arbitrary dataset and the responses envisioned through the linear approximation of the information (visually that is noticeable because the sum of the vertical distances between every records factor within the set and the corresponding factor on the regression line - the smaller the variations, the higher the mannequin matches the knowledge). The following estimator will also be expressed with the aid of a easy system, primarily in the case of a single regressor on the correct-hand side.

The OLS estimator is normal while the regressors are exogenous and there is also no best multicollinearity, and most advantageous within the class of linear impartial estimators when the mistakes are homoscedastic and serially uncorrelated. Underneath those circumstances, the procedure of OLS affords minimal-variance suggest-impartial estimation when the errors have finite variances. Beneath the extra assumption that the blunders be most commonly dispensed, OLS is the highest probability estimator. OLS is utilized in economics (econometrics), political technological know-how and electrical engineering (manage concept and sign processing), amongst many areas of utility. The Multi-fractional order estimator is an accelerated model of OLS.

**Simple linear regression:** In information, handy linear regression is the least squares estimator of a linear regression mannequin with a single explanatory variable. In different phrases, easy linear regression suits a straight line through the set of n facets in the sort of approach that makes the sum of squared residuals of the version (that is, vertical distances among the motives of the data set and the outfitted line) as small as viable.

The adjective easy refers back to the truth that the ultimate results variable is associated with a single predictor. The slope of the outfitted line is equal to the correlation amongst y and x corrected via the ratio of standard deviations of those variables. The intercept of the prepared line is such that it passes via the center of mass (x, y) of the records facets.

Different regression techniques besides the easy normal least squares (OLS) additionally exist (see linear regression). Specially, while one wants to do regression by means of making use of eye, one almost always has a tendency to attract a barely steeper line; toward the only produced by using using the complete least squares process. This happens for the reason that it's higher common for one's intellect to don't forget the orthogonal distances from the observations to the regression line, in option to the vertical ones as OLS manner does.

**REGRESSION MODEL OF PROFIT MARGIN**

Model 10: OLS, using observations 1-30  
 Dependent variable: Dividend Payout Ratios  
 Heteroskedasticity-robust standard errors, variant HC1

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
Const	32.0049	23.5666	1.3581	0.1871	
Current ratios	-0.451716	0.16608	-2.7199	0.0119	**
Ownership Structure	53.8353	28.2198	1.9077	0.0685	*
Net Profit Margin	0.959673	0.433763	2.2124	0.0367	**
Return on Assets	1.25506	0.323328	3.8817	0.0007	***
Quick Acid test	0.363064	0.30999	1.1712	0.2530	

ratios

Mean dependent var	56.73743	S.D. dependent var	94.10187
Sum squared resid	75990.67	S.E. of regression	56.26969
R-squared	0.704086	Adjusted R-squared	0.642437
F(5, 24)	3.859054	P-value(F)	0.010443
Log-likelihood	-160.1257	Akaike criterion	332.2514
Schwarz criterion	340.6586	Hannan-Quinn	334.9409

**Table 4.1 Regression of Profit Margin**

#### 4.1 RESULT

##### ***Robust Standard Errors:***

strong general mistakes or white hubber widespread errors is also known as sandwich estimate of inconsistency. this mistake is used for multilevel regression for unremitting variables shows to precise difficulty regarding the normality assumption, because non-regular facts hold cause incorrect preferred mistakes estimates, and, as a result, outcome assessments. the nature of the effect on widespread errors depends on the form of the distribution. There many creator worked on adjustments to the same old mistakes estimation and provide their suggestion like, (Burton, Gurrin, & Sly, 1998; Huber, 1967; Liang & Zeger, 1986; White, 1982). sturdy estimates may execute dominant whilst there are a hundred stage-2 devices (businesses) or more (Cheong, Fotiu, & Raudenbush, 2001; Hox & Maas, 2001; Krauermann & Carroll, 2001). There may be a mere value in power (strong estimates will have a tendency to be slightly large than standard asymptotic estimates), however, with enough variety of companies, the minimum energy loss is probably less of a situation than no normality.

##### ***Coefficient of Determination***

From the above table 4.1 the value of R-squared is 0.70 which shows that the 70 percent variation in Dividend Payout Ratios has been explained by the all independent variables i.e. current ratios, ownership structure, net profit margin, and return on assets. Normally, higher R-square value is representation of significant results.

##### ***Fitness of Model***

Generally, F-test is used for analyzing fitness of the model.

First step of any statistical hypothesis testing is to formulate hypothesis, so hypothesis are as follow:

Null Hypothesis:  $H_0 =$  Model is not fit

Alternate Hypothesis:  $H_A =$  Model is fit

In second step, study has to decide its significance level. The study has 5% significance level. Third step includes decision of test, for fitness of model; study has to use f-test statistics. In last step, there is comparison of calculated value with tabulated value. As study results calculated value is 3.859054 F (5, 24), study has to compare it with tabulated value. Tabulated value of F (5, 24) is 3.19, as calculated value of f-test is greater than tabulated value, in this case study has to reject null hypothesis i.e. Model is not fit. Finally, study has to accept alternate hypothesis, so, our model is fit.

Alternate way of checking value of f-test is to compare p-value with significance level. If significance level is greater than p-value then study has to reject null hypothesis. In the study result, p value is 0.010. Which is showing that significant level (0.05), so study has to reject null hypothesis and accept alternate hypothesis. So, study model is fit.

##### ***Coefficients***

###### ***1. Current ratio***

As study result has coefficient value of -0.45, which means there exist negative relationship between current ratio and dividend payout ratio. Unit change in current ratio is changing dividend payout ratio with -0.45. There are some studies that has shown negative relationship between current ratio and dividend payout ratio like Gillet. Al, (2010) in their study concluded that relationship among the cash flow and dividend payout ratios is negative for both manufacturing and service industry of US (United State) capital market, moreover there are many studies, with consideration(Hameeda,1972; Rozaff,1982; Ozkan,2004) leverage and cash flow volatility are negatively related to dividend payout ratios.

## **2. Ownership Capital**

Possession capital has beta price of 58.Eighty three; value of coefficient is excessive considering the fact that ownership capital is dummy variable. Outcome exhibit that there exists confident relationship between possession capital and dividend payout ratio. There are a lot of reports argued constructive relationship among the many possession structure like link between dividend coverage and institutional coverage evaluate the abilities association between possession structures and dividend coverage. In addition dividend models of Lintner (American financial evaluation, 46 (1956) ninety seven), Waud (Journal of the American Statistical association, 1996) and Fama and Babiak (Journal of the American Statistical association, 63 (1968) 1132] constructive relationship

## **3. Net Profit Margin**

Net profit margin importance cannot be ignored, because almost all the studies has shown positive strong relation between net profit margin and dividend payout ratio. Likewise, our study results are also favorable, because value of coefficient is 0.95; which means there exist strong direct relation between independent variable (current ratio) and dependent variable (dividend payout ratio). Unit change in net profit margin is changing dividend payout ratio with 0.95.

## **4. Return on Asset**

Return on asset is also important one, and most of studies show positive relationship. Same is the case with our study results; there exist strong direct relation between ROA with dividend payout ratio.

### ***T-test Statistics***

#### **1. Current Ratio**

Generally, t-test is used for analyzing coefficients.

First step of any statistical hypothesis testing is to formulate hypothesis, so hypothesis are as follow:

Null Hypothesis:  $H_0 \beta=0$

Alternate Hypothesis:  $H_A \beta \neq 0$

In second step, study has to decide its significance level. Our study has 10% significance level. Third step includes decision of test, for analyzing coefficient; study has to use t-test statistics. In last step, there is comparison of calculated value with tabulated value. As our calculated value is t-test is 2.17, study has to compare it with tabulated value. Tabulated value of t-test (0.10, 29) is 1.31143, as calculated value of t-test is greater than tabulated value, in this case study has to reject null hypothesis i.e. $\beta=0$ . Finally, study has to accept alternate hypothesis, so, $\beta \neq 0$ . So, there is some impact of current ratio on dividend payout ratio.

Alternate way of checking value of t-test is to compare p-value with significance level. If significance level is greater than p-value then we have to reject null hypothesis. In our study result, p value is 0.0119. As significance level (0.10) is greater than p-value (0.0119), so study has to reject null hypothesis and accept alternate hypothesis. So,  $\beta \neq 0$ .

#### **2. Ownership Structure.**

Ownership structure calculated value t-test is 1.9077: study has to compare it with tabulated value. Tabulated value of test (0.10,29) is 1.31143, as calculated value of test is greater than tabulated value, in this case study has to reject null hypothesis i.e.  $B=0$ . Finally, study has to accept alternate hypothesis, so  $B \neq 0$ . So there is some impact of ownership structure on dividend payout ratios.

Alternate way of checking value of t-test is to compare p-value with significance level. If significance level is greater than p-value then we have to reject null hypothesis. In our study, p value is 0.00685. As significance level (0.10) is greater than p-value (0.00685), so study has to reject null hypothesis and accept alternate hypothesis, so,  $B \neq 0$ .

**3. Net profit Margin**

Net Profit Margin calculated value t-test is 2.2124: study has to compare it with tabulated value. Tabulated value of test (0.10,29) is 1.31143, as calculated value of test is greater than tabulated value, in this case study has to reject null hypothesis i.e.  $B=0$ . Finally, study has to accept alternate hypothesis, so  $B \neq 0$ . So there is some impact of ownership structure on dividend payout ratios.

Alternate way of checking value of t-test is to compare p-value with significance level. If significance level is greater than p-value then we have to reject null hypothesis. In our study, p value is 0.0367. As significance level (0.10) is greater than p-value (0.0367), so study has to reject null hypothesis and accept alternate hypothesis, so,  $B \neq 0$ .

**4. Return on Assets.**

Return on Assets calculated value t-test is 3.8817; study has to compare it with tabulated value. Tabulated value of test (0.10,29) is 1.31143, as calculated value of test is greater than tabulated value, in this case study has to reject null hypothesis i.e.  $B=0$ . Finally, study has to accept alternate hypothesis, so  $B \neq 0$ . So there is some impact of ownership structure on dividend payout ratios.

Alternate way of checking value of t-test is to compare p-value with significance level. If significance level is greater than p-value then we have to reject null hypothesis. In our study, p value is 0.007. As significance level (0.10) is greater than p-value (0.007), so study has to reject null hypothesis and accept alternate hypothesis, so,  $B \neq 0$ .

**5. Quick Acid Test Ratios.**

Quick Acid Test value t-test is 1.1712; study has to compare it with tabulated value. Tabulated value of test (0.10,29) is 1.31143, as calculated value of test is less than tabulated value, in this case study has to reject null hypothesis i.e.  $B \neq 0$ . Finally, study has to accept residual are not heteroscedastic , that is homoscedic.

**Normality test**

Frequency distribution for uhat10, obs 1-30  
 number of bins = 7, mean = 8.941e-015, sd = 56.2697

interval	midpt	frequency	rel.	cum.	
< -102.25	-120.50	1	3.33%	3.33% *	
-102.25 -	-65.738	-83.992	2	6.67%	10.00% **
-65.738 -	-29.230	-47.484	6	20.00%	30.00% *****
-29.230 -	7.2769	-10.977	6	20.00%	50.00% *****
7.2769 -	43.784	25.531	10	33.33%	83.33% *****
43.784 -	80.292	62.038	4	13.33%	96.67% ****
>= 80.292	98.545	1	3.33%	100.00% *	

Test for null hypothesis of normal distribution:  
 Chi-square(2) = 0.449 with p-value 0.79895

**Table 4.2 Normality test Modal**

**Step:1**

Formulation of hypothesis

Null Hypothesis  $H_0$ = Residual are normally distributed

Null Hypothesis= $H_A$ : Residuals are not normally distributed

**Step2**

Significant for this test is 0.05

**Step3**

Calculated value is 0.449, tabulated value of chi-square (2) is 5.99146

**Step4**

**Decision (Condition 1)**

If calculated value is chi-square (2) is greater than critical tabulated value of chi-square (2) then study will reject null hypothesis.

As our results shows that calculated value is not greater than tabulated value so, in this case study is accepting null hypothesis which mention that residual study variables are normally distributed.

**Condition 2**

If P-value is less than significance level then study reject  $H_0$ . But in study results P-value (0.798) is greater than significance level (0.05) so, study is going to accept  $H_0$ .

**Breusch-Pagan test for heteroskedasticity**

OLS, using observations 1-30

Dependent variable: scaled  $\hat{u}^2$

	Coefficient	std. error	t-ratio	p-value
Const	0.585324	0.468797	1.249	0.2239
Current ratios	-0.000535293	0.00290853	-0.1840	0.8555
Ownership Structure~	-0.0303219	0.663037	-0.04573	0.9639
Net Profit Margin	-0.0160198	0.0114325	-1.401	0.1739
Return on Assets	0.0147021	0.00348669	4.217	0.0003 ***
Quick Acid test rat~	0.00313384	0.00597697	0.5243	0.6049

Explained sum of squares = 21.3191

Test statistic: LM = 10.659569,  
 with p-value =  $P(\text{Chi-square}(5) > 10.659569) = 0.058564$

**Table 4.3 Breusch-Pagan test for heteroskedasticity**

### ***BREUSCH-PAGAN TEST***

Normally, In Breusch–Pagan test, developed in 1979 through Trevor Breusch and Adrian Pagan, this test is used for Heteroscedasticity in a linear regression mannequin. It exams whether the estimated variance of the residuals from a regression are based on the values of the impartial initial step of any statistical hypotheses trying out is to formulate speculation, so hypotheses are as beneath:

#### ***Step:1***

Formulation of hypothesis:

Null Hypothesis:  $H_0 = \text{constant variance / homoscedasticity}$

Alternate Hypotheses:  $H_A = \text{Heteroscedasticity}$

#### ***Step: 02***

Significant for this test is  $P < 0.05$

#### ***Step3***

Calculated value is 0.058564, tabulated value of chi-square (2) is \_\_\_\_\_

#### ***Step4***

#### ***Decision (Condition 1)***

If calculated value is chi-square (2) is greater that critical tabulated value of chi-square (2) than study will reject null hypothesis.

As our results shows that calculated value is not grater that tabulated value so, in this case study is accepting null hypothesis which mention that residual study variables are normally distributed.

#### ***Condition 2***

If P-value is less that significance level than study reject  $H_0$ . But in study results P-value is greater that significance level (0.05) so, study is going to accept  $H_0$ .

### **5.1 Summary**

Dividend payout Policy play a very significant part in any compan's financial performance. This stuy find that in pakistan there is only family business , there are few companies are paid dividend which are listed on Karachi Stock Exchange. I am slected 52 companies randamly in which there are 30 compnaies are paid dividend. This study was collected the data through companies official websites and published material. Study included variables like (Dividend Payout Ratios is dependent variables and Current Ratios, Quick Acid Test Ratios, Financial leverage Ratios, Debt to Equity Ratios, Ownership Sructure, Net Profit Margin, return on Assets as an independent variables.

Study used different formullas in microsoft excel application to calculate profit margin and return on equity ratios and calculate independent variables from audit financial statement of firms. Then study created OLS model to apply regression and other different tests. Applying the Heteroskedasticity test study find the coefficient determination 0.70 which shows that dependent variables explain 70% variation in dividend payout ratios.

Study used the F-test for analyzing the fitness of model. Value of F-test of Current Rarios is 3.859054  $F(5,24)$  study compared with tabular value of (5,24) is 3.19. The value of F-test is greater then tabular value which shows that model if fit. Ownerhsip Structre has beta value is 58.83, value of coefficient is high beacuae Ownership capital is dummy variables. Net Profit Margin shown positive straong raelationship among the net profit margin and dividend payout ratios, bacuaese the value of coefficinet is 0.95 . Retur on Assets strong relationship on the dividend Payout Ratios.

Study used the T-test for analyzing coefficients. The value of Current ratios in t-test is 2.17, study compared this value in tabulared value (0.10,29) 1.31143. So the value of t-test is greater then tabulared value, study has rejected null hypotheses. Ownership Structure

t-test value is 1.9077, study compare this value in tabulated value (0.10,29) is 1.31143. So the value of t-test is greater than tabulated value, study has rejected null hypotheses. Net Profit Margin t-test value is 2.2124, study compare this value in tabulated value (0.10,29) is 1.31443. So the value of t-test is greater than tabulated value, study has rejected null hypotheses. Return on Assets t-test value is 3.8817, study compare this value in tabulated value (0.10,29) is 1.31143. So the value of t-test is greater than tabulated value, study has rejected null hypotheses. Quick Acid Test Ratios t-test value is 1.1712, study compare this value in tabulated value (0.10,29) 1.31143. So the value of t-test is less than tabulated value, study has accepted residual are not heteroscedastic, that is homoscedastic.

## 5.2 Conclusion

The main purpose for study was to determine dividend Payout Policy of firms Karachi Stock Exchange between the periods of (2005-2014), in Pakistan there is 70% family business, mostly companies are not give the dividend, but few companies are giving dividend.

Using the data of companies listed on Karachi Stock Exchange; Study finds that the good corporate governance practices on firm's financial performance. The role of this study is important for both academic researchers and business managers. This study boosts the validity of previous studies on relationship between corporate governance and financial performance and makes several significant contributions to the literature. This study finds that the board size, audit committee has the positive relationship with profit margin and return on equity.

## 5.3 Policy Recommendation

Find the impact of corporate governance on financial performance of Karachi Stock Exchange companies, which shows that board size and audit committee has positive relationship with profit margin and return on equity. If the board size members increased the result may be positive on profit margin as well as return on equity and similarly the external audit committee members increased the profit margin and return on equity also increased. This study help the companies managers to use this strategy to get more benefit.

## APPENDIX

Appendices, if needed, appear before the acknowledgment.

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# Comparative Evaluation of C-reactive Protein and Total Leucocyte Count in Conventional Laparoscopic Cholecystectomy and Single Incision Laparoscopic Cholecystectomy

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**Abstract-** To study the role of and do the comparative evaluation of the levels of C-Reactive Protein and Total Leucocyte Count in patients of conventional laparoscopic cholecystectomy and Single incision laparoscopic cholecystectomy.

**Method:** The present prospective study included ultrasonographically proved 50 patients of symptomatic cholelithiasis and were posted for elective cholecystectomy. These patients were admitted in Surgical Wards of Indira Gandhi Medical College, Shimla .SILC were performed on 25 (50% of patients) and cLC were conducted in rest of 25 (50%) patients. The patients were selected randomly. Relevant history, clinical examination and investigations were recorded. The consent of all these patients was taken. All the patients were subjected to same general anesthesia, antibiotics, perioperative analgesics and intravenous fluids. SILC was done by infra umbilical incision and cLC was done by three /four Trocar Technique.

**Results:** The age of patients included in the study ranged from 15 years to 58 years with mean age of 39.45 years. The mean age was 30.80 years in the single incision laparoscopic cholecystectomy and 35.40 years in conventional laparoscopic cholecystectomy group respectively, which is statistically insignificant ( $p$ -value = 0.095). In the present study 86% of the total patients were females, 14% were males. The BMI ranged from 18-30 Kg/m<sup>2</sup> with mean BMI of 21.44 Kg/m<sup>2</sup>. CRP on second post operative day of these patients ranged from 6.2 mg% to 120 mg%. In the SILC group, CRP mean was 61.98 ± 37.06 mg% in the cLC group, CRP mean was 65.08 ± 39.6 mg%. The  $p$ -value for CRP at second post operative day between SILC and cLC group was 0.781. The  $p$ -value for TLC on second post operative day between SILC and cLC was 0.29.

**Conclusions:** Single incision laparoscopic cholecystectomy appears to be as safe, effective and feasible technique and good alternative to conventional laparoscopic cholecystectomy with potential advantages of cosmesis. The cost associated with single incision laparoscopic cholecystectomy and conventional laparoscopic cholecystectomy procedures appear similar. Ultimately, the decision as to whether to perform single incision laparoscopic cholecystectomy or conventional laparoscopic cholecystectomy will be depended on the preferences of individual surgeons and patients.

**Index Terms-** Laparoscopic cholecystectomy, single port, conventional cholecystectomy.

## I. INTRODUCTION

Over the last 20 years, conventional laparoscopic cholecystectomy (cLC) as less invasive method, has replaced open cholecystectomy in the treatment of patients with symptomatic gallstone disease. In recent years, a search for even more minimally invasive approaches has led to innovative techniques of single incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES). While substantial drawbacks of NOTES technique including technical challenges and scarcity of instrumentation, have limited its adoption so far<sup>1</sup> the SILS has met more favorable acceptance in surgical community. Its feasibility and safety have been proved in a number of surgical procedures including cholecystectomy<sup>2, 3</sup>.

Compared to conventional LC which is performed via three or four abdominal ports, the single incision laparoscopic cholecystectomy (SILC) is performed using only one infra umbilical entry into the abdominal cavity. The first SILS procedures were done with several ports placed next to each other through a single skin incision but with multiple fascial perforations<sup>4, 5</sup>. Recent development of multichannel port devices allows entry into the abdominal cavity through a single fascial incision. Diminishing the number of ports to only one seems attractive due to its potential to reduce wound related complications, to decrease postoperative pain and to improve cosmetic outcome.

Surgery, “controlled deliberate injury”, for purpose of therapy, induces a series of biochemical and hormonal responses in the body, that include alteration in the expression of acute phase reactants C-reactive protein (CRP) and total leucocyte count (TLC). In general, the magnitude of changes in CRP is apparently taken as proportional to the extent of overall surgical insult<sup>7</sup>.

Recent evidence indicates that trauma induced stress hormone responses are insufficient to explain the broad spectrum of post injury defects, particularly in relation to immune system. Stress of injury leads to production of cytokines and acute phase proteins, which initiates increase in the levels of “Stress” hormones, loss of muscle proteins, greater vascular permeability and changes in white blood cell count. Some of these responses are homeostatic defense mechanism but others such as catabolic state are thought to be deleterious. Magnitude of metabolic response to surgical trauma, is proportional to degree of injury

and reduction of excess trauma by “Laparoscopic Techniques” might therefore diminish the response.

Generation of acute-phase proteins is well recognized response to tissue injury. CRP is a key marker of acute phase protein and provides dependable screening test, for acute phase reactants<sup>6</sup>. Post operative rise in CRP and TLC have been reported by many researchers, whereas other workers have found no significant difference in CRP levels between conventional LC(cLC) and SILC<sup>7</sup>.

Since the introduction of conventional laparoscopic cholecystectomy (cLC) and SILC in our institution, we have been seeing how easily and rapidly patients recover from surgery. An effort was made in the present study to comparatively evaluate the pattern and magnitude of metabolic response to injury by assessing role of CRP and TLC as stress markers in conventional laparoscopic cholecystectomy and SILC.

## II. MATERIAL AND METHODS

The present prospective study included ultrasonographically proved 50 patients of symptomatic cholelithiasis and were posted for elective cholecystectomy. These patients were admitted in Surgical Wards of Indira Gandhi Medical College, Shimla. SILC were performed on 25 (50% of patients) and cLC were conducted in rest of 25 (50%) patients. The patients were selected randomly. Relevant history, clinical examination and investigations were recorded as per performa attached (annexure 1). The consent of all these patients were taken as per consent form (annexure 2). All the patients were subjected to same general anesthesia, antibiotics, perioperative analgesics and intravenous fluids. SILC was done by infra umbilical incision and cLC was done by three /four Trocar Technique.

## III. INCLUSION CRITERIA

All patients with ultrasonographically proved symptomatic cholelithiasis, fit for general anaesthesia were included in the study.

**Patients having following conditions have been excluded from the study.**

1. Acute Cholecystitis /Pancreatitis.
2. Choledocholithiasis
3. Jaundice / Hypoproteinemia/Malignancy
4. History of Allergy, Taking Steroids and Chemotherapy
5. Patients on Oral Contraceptive Pills/Pregnancy
6. Patients requiring peri-operative blood transfusion.
7. Conversion of cLC to OC.
8. Intra operative injury to adjacent organs/structures.
9. Patients developing peri-operative complications.

Serial measurements of TLC and CRP were done by sampling blood which was collected as mentioned below:-

1. Baseline Sample- Pre-operatively after overnight fasting.
2. At the time of completion of surgery within 6 Hours.
3. 1<sup>st</sup> Post Operative day.
4. 2<sup>nd</sup> post operative day.

Data collected was analyzed statistically by using paired ‘t’ test.

## IV. C-REACTIVE PROTEIN ESTIMATION

3 ml of clotted blood sample was taken. The concentration of CRP was measured by NYCOCARD CRP SINGLE TEST KIT AND USING NYCOCARD READER II (AXIS- SHIELD, Norway).

### MATERIAL

TD (Test Device) : Plastic device containing a membrane coated with monoclonal anti-CRP antibodies.

R-1 (Dilution Liquid) : (0.4 ml) Borate buffer (pH 9.0) and detergents.

R2 (conjugate) : (1 x 3.5 ml) Solution containing monoclonal anti-CRP antibodies with ultra small gold particles.

R3 (Working Solution) : (1 x 3.0 ml) Phosphate buffered NaCl solution (pH 7.4) and detergents

C+ (Control Positive) : (1 x 05 ml) Serum of human origin with added purified CRP

Capillary tubes : 5 ml end to end glass capillaries

Pipette (5 ml) and pipette tips

Capillary tube holder

Nycocard Reader II

### Test Procedure

1. 5 µL capillary was filled with patient sample or C+ (Control Positive), and the capillary was dropped into the tube with R1(Dilution Liquid). The tube was closed and mixed well for 10 seconds.
2. 50 µL diluted sample or dilute C+ (Control Positive) was applied to the TD (Test Device). The sample was allowed to soak into the membrane (approx. 30 second).
3. One drop R/2 Conjugate was allowed to the TD (Test Device). The reagent was allowed to soak into the membrane (approx. 30 seconds).
4. R3 (Washing Solution) was allowed to the TD (Test Device). The reagent was allowed to soak into the membrane (approx. 20 second).

- The result was read within 45 minutes using the NycoCard READER II following the READER II user instruction manual.

## V. TOTAL LEUCOCYTE COUNT ESTIMATION

TLC was measured by AUTOMATED HEMATOLOGY CELL COUNTER (MELET SCHLOESING LABORATORIES OSNY-FRANCE)

- A collecting tube with anticoagulant EDTA K3 (violet or blue cap) was filled upto 2/3<sup>rd</sup> with the blood sample.
  - Blood and anticoagulant were mixed thoroughly by inverting the tube 10 times .
  - Appropriate bank was selected i.e. male adult /female adult/child .After selecting appropriate bank that particular bank was saved.
  - The MS9 was ready to run the sample.
- Following procedures were followed.

- Cap was taken off the tube
- The tube was placed in the holder by choosing the correct adaptor for the volume of the sample tube (red, blue, white or green)
- The analysis was started automatically by pressing << ALT >> C.
- The tube was taken out after the end of the analysis.
- The result was automatically displayed once the counting was done.

## VI. CONVENTIONAL LAPAROSCOPIC CHOLECYSTECTOMY

First of all, the patient was asked to pass urine before entering operation theatre. With patient in supine position, general anesthesia was given. Cleaning and draping was done in the standard fashion. The patient was placed in reverse Trendelenberg position of 30 degree while rotating the table to left by 15 degree. This maneuver allowed the duodenum and colon to fall away from the liver edge.

The operating surgeon stood to the patient's left, the camera operator to the surgeon's left and the assistant on the patient's right. The video monitor was placed on the patient's right at the level of the shoulder, to give an unobstructed view for the surgeon and camera assistant.

The Veress needle was inserted through a stab incision in the infra-umbilical region, almost perpendicular to the abdominal wall with a slight angle towards the pelvis. Saline drop test was done for checking correct placement of Veress needle. (Saline drops were injected into peritoneal cavity. When no aspirate was returned, it checked the correct placement of Veress needle)

Pneumoperitoneum was created using this Veress needle through which CO<sub>2</sub> was insufflated into peritoneal cavity to a pressure of 13mm of Hg. 10mm incision was made for 10mm trocar at the site of stab incision in the infra-umbilical region. The trocar was inserted towards the pelvis at an angle of about 80 degree to the anterior abdominal wall.

Laparoscope was introduced through the umbilical port and a complete examination of abdominal cavity was performed.

The second trocar was placed under direct laparoscopic vision in the midline between the xiphoid and the umbilicus through a 10mm incision, ensuring that its entry into abdominal cavity was on the right side of the falciform ligament. Also the trocar was directed towards the gall bladder, so that there was no need to reposition it continuously throughout the procedure.

Two 5mm ports were placed, one in the subcostal region, in the midclavicular line for the atraumatic grasper for the left hand of the surgeon and another at the level of umbilicus along anterior axillary line for the assistant's ratchet ( with lock ) grasper, by 5mm stab incisions.

With the laparoscope through the umbilical port, a ratchet grasper was introduced through the lateral 5mm trocar to grasp the fundus of the gall bladder. The assistant applied traction upward and backward to establish optimal exposure.

Another atraumatic grasper was introduced through the midclavicular port. When the anatomy was evident, the grasper was used to catch Hartmann's pouch and apply the necessary traction.

Working with both hands , the surgeon took the grasper that holded Hartmann's pouch in his or her left hand and applied upward and lateral traction to identify the structures in the cholecystoduodenal ligament and the common bile duct.

A 5 or 10mm instrument, generally an atraumatic Maryland curved dissector was introduced through the subxiphoid port with the right hand and blunt dissection was started in the cholecystoduodenal ligament, which was simple when there was no intense acute or chronic inflammation. This dissection allowed identification of the cystic duct, bile duct and cystic artery.

Once the junctions of the cystic duct to the gallbladder and to the bile duct were identified and the right peritoneal attachment of the gallbladder dissected out, traction was applied to Hartmann's pouch to the right side of the patient and slightly upwards to enable dissection of the left peritoneal attachment. At this point care was taken to avoid injury to the small arteries that accompany the cystic lymph node located near the cystic artery bifurcation.

In case of haemorrhage, the Monopolar Electrocautry or harmonic scalpel was used.

Once all the structures were clearly identified then the cystic duct and artery were divided. To perform this, two staples were placed in the cystic duct, using clip applicator, one proximal to the main duct and the other as close as possible to the gallbladder to prevent spillage.

Two staples were placed distally and one proximally on the cystic artery and both structures were divided with metzenbaum scissors. To dissect and release the gallbladder from the rest of the hepatic bed, a hook or spatula connected to the monopolar Electrocautry device was used, with the irrigation and aspiration at the same time. Dissection was performed ensuring careful haemostasis while the graspers in the fundus and Hartman's pouch were used to give a good exposure.

Before removing the gallbladder completely, a careful examination of the hepatic bed was performed to verify haemostasis and the bleeding points were cauterized. Drains were left as a routine in most of the cases, introduced by most lateral 5mm port.

The gall bladder was extracted by subxiphoid port by claw forceps. All incisions of 10mm were sutured with vicryl (port closure 35mm) to avoid herniations and post operative complications.

## VII. SINGLE INCISION LAPAROSCOPIC CHOLECYSTECTOMY

### **Equipment and Instruments:**

We used conventional laparoscopic instruments and equipment for performing SILC. We used 5mm laparoscope for performing the procedure. A sharp image that allows clear distinction between tissue planes and tissue textures is essential for safe dissection.

### **Position of the patient, team and equipment:**

The patient was positioned supine on the operating table with the legs split apart and strapped firmly to the leg boards. Both arms of the patient were placed on arm boards at an angle less than 90° to the torso. The surgeon stood on the left side of the patient, with the assistant opposite to him during the placement of the first port. For rest of the procedure, the surgeon stood between the legs and the camera person stood to his right (near the left leg of the patient). The monitor trolley was placed above the patient's right arm. The diathermy pedal was placed near the surgeon's left foot and all tubes and cables were fixed such that they do not interfere with the camera person.

### **Placement of ports:**

We had given an infraumbilical curved incision. The umbilicus was everted and held with two-toothed forceps in a cephalic and caudal position prior to making an incision of length 2-2.5 cm. This was deepened through the fat and the flaps were undermined to expose the fascia over a distance of 2-2.5 cm. The left edge of the skin incision was retracted and a fascial stab incision was made. A Veress needle was introduced through this incision and after confirmation of its intraperitoneal position; CO<sub>2</sub> pneumoperitoneum was induced and maintained at 12 mm Hg. In the initial cases a 10 mm port was inserted at the incision line and the two five mm ports were placed 0.5 cm inferiorly and laterally on either side through the same skin incision. A grasper introduced through the right lateral port was used for fundal traction. The dissector introduced through the left lateral port was used to dissect the fine Calot's triangle. The instrument port and the telescope port were crossed by a chopstick method to avoid "sword fighting" and clashing of instruments in the abdomen. At this stage, the patient's position was changed to an anti-Trendelenberg one with a left-sided tilt which helped in the better exposure of the Calot's triangle. Later we used only two ports one five mm port for five mm camera and another was ten mm working port through which laparoscope, needle holder, grasper and extractor were introduced at the various steps of SILC procedure.

### **Placement of traction sutures :**

This was the key step of the SILC i.e. "puppeteer"<sup>8</sup> technique, in which traction sutures were used to hold gall bladder. At the beginning of the procedure, a grasper or a

dissector was used to move the omentum away from the right upper quadrant so as to obtain a view of the fundus of the gallbladder. Flimsy omental adhesions, if present, were teased off at this stage. We used a strand of 1-0 vicryl on a 60-mm straight needle for placing the traction sutures. The needle was introduced laterally through one of the intercostal spaces above the level of the costal margin on right side. A laparoscopic needle holder brought the needle into the peritoneal cavity and placed it on the omentum. The needle was then regrasped at its midpoint, a bite of the fundus of the gallbladder was taken and the needle was driven out through the same intercostal space. The needle was retrieved using an open needle holder and the suture was pulled out leaving two ends of 5-6 cm. The suture was divided and a haemostat was applied to both ends close to the skin, resulting in elevation of the gallbladder fundus. Another traction suture was taken in which the needle was introduced from the epigastric region just below the xiphi sternum. This needle was passed through the Hartmann's pouch with the help of needle holder and then taken out from lateral abdominal wall. Both ends were held with hemostats. This helped in lifting the Hartmann's area and helped in better dissection.

### **Dissection of the Calot's triangle:**

The posterior peritoneum was divided to free the Hartmann's pouch. This was followed by further dissection of the anterior and posterior peritoneal leaves overlying the Calot's triangle with the help of a hook and/or a Maryland dissector. The cystic artery and the cystic duct were skeletonised - the endpoint of this dissection was obtaining a "critical view".

### **Control of the cystic artery:**

The two windows in the Calot's triangle were dissected more widely than during a conventional LC so as to safely observe the tips of the instruments controlling the artery and the duct. We had clipped the cystic artery with a 10-mm reusable clip applicator. Subsequently, the cystic artery was divided.

### **Control of the cystic duct:**

If the cystic duct appeared narrow, it was clipped thrice with 10-mm clips and divided. If the duct appeared wide, we preferred to pass a No. 1 polyglactin suture around it, exteriorize the same and fashioned an extracorporeal Meltzer's knot. This knot was then snugged down onto the cystic duct with the help of a metal knot-pusher. The duct was divided between two extracorporeally tied ligatures. If there was a suspicion of an impacted stone in the cystic duct, it was controlled on the gallbladder side, divided partially to allow the stone to be milked out, and then the stump was ligated using extracorporeal knotting. A 10-mm port was used for introducing a spoon forceps for the retrieval of stones from cystic duct or those that may spill from the gallbladder if it was perforated during dissection. The divided ends of the cystic artery and duct were carefully inspected to confirm their secure closure.

### **Dissection of the gallbladder:**

Alternating medial and lateral rotation of the gallbladder using the ends of the suture placed on Hartmann's pouch was done to dissect the gallbladder from the liver bed using a diathermy hook. Prior to the final detachment of the gallbladder,

meticulous haemostasis in the liver bed was ensured and the subhepatic space lavaged with saline. The fundal traction suture was loosened and the gallbladder was freed from the liver.

**Specimen extraction:**

Gall bladder was then held at neck with the grasper and extracted through the umbilical 10 mm port.

**Closure of the incision:**

Careful closure of the fascial incision was done to prevent formation of port-site hernia. The edges of the fascial incision were identified, grasped and elevated using fine Kocher's forceps. We closed the rectus sheath using vicryl no.1 suture. The fascia and the skin were infiltrated with a local anaesthetic and the skin was closed using sutures.

**Postoperative course:**

The postoperative care was identical to that of patients undergoing standard laparoscopic cholecystectomy. Intravenous analgesics and anti-emetics were administered for the duration of hospital stay. Patients were allowed to ambulate and take liquids after 6-8 hours of surgery. Findings were recorded as per Performa attached

**VIII. RESULTS**

The present study was conducted in the Department of Surgery, IGMC, Shimla over a period of 1 year from 1<sup>st</sup> July, 2012 to 30<sup>th</sup> June, 2013 on 50 patients who were admitted for elective cholecystectomy. These patients were alternatively divided into two groups of 25 patients each. Group 'A' included patients in whom SILC was done and Group 'B' included patients who underwent cLC. Detailed history was taken, thorough clinical examination was done and appropriate investigations were carried out in each case which were recorded in the Performa attached. The following observations were made:

**1:- AGE DISTRIBUTION IN SINGLE INCISION AND CONVENTIONAL LAPAROSCOPIC CHOLECYSTECTOMY GROUP:-**

The age of patients in the present study ranged from 15 to 58 years. In SILC group, the age ranged from 15 to 58 years and the mean age was 30.88±9.248 (standard deviation) years, whereas in cLC group, the age ranged from 15 to 54 years and the mean age was 35.20±9.923 (standard deviation) years. Patients were grouped as : below 30 years,30-45 years and more than 45 years .Majority of patients were in between 30-45 years and were 56% and 68% in SILC and cLC groups respectively . The youngest patient in SILC group was 15years of age, whereas in cLC group, youngest patient was of 16 years (see master charts). The p value for age of patients between SILC and cLC groups was 0.095 . (Table 1a,1b) .

**Table no 1a :- GROUP STATISTICS (AGE)**

Group	N	Mean	Std. Deviation	Std. Error
Age SILC	25	30.88	9.248	0.850
cLC	25	35.32	9.923	0.980

**Table no 1b :- Age Distribution**

Age (years)	SILC		Clc	
	No. of patients (n=25)	%age	No. of patients (n=25)	%age
<30	10	40	5	20
30-45	14	56	17	68
>45	1	4	3	12

pvalue= .095, (p >0.05 - insignificant).

**2:- SEX DISTRIBUTION:-**

Out of 50 patients, 43 patients (86%) were female and 7 patients (14%) were male. In the SILC group 24 patients (96%) were female and only 1 patient (4%) was male, whereas in the cLC 19 patients (76%) were females and 6 patients (24%) were males. (Table 2)

**Table no 2 :- Sex Distribution**

p value= 1.00 (p >0.05- insignificant)

Sex	SILC		Clc	
	(n=25)	%age	(n=25)	%age
Male	1	4	6	24
Female	24	96	19	76

**3:-BASAL METABOLIC INDEX (BMI) :-**

The BMI ranged from 18 to 30 kg/m<sup>2</sup> with mean BMI of 21.08 whereas it was 21.04 and 21.88 in the SILC and cLC groups respectively. The p value is0.20 which is statistically insignificant. (Table 3)

**Table no 3 :- BASAL METABOLIC INDEX (BMI) :-**

BMI(Kg/M <sup>2</sup> )	SILC		c LC	
	No. of patients (n=25)	%age	No. of patients (n=25)	%age
18-20	16	64	2	8
21-23	9	36	15	60
24-26	0	0	6	24
27-29	0	0	1	4
30-32	0	0	1	4
<b>MEAN</b>	21.04		21.88	

p value= .20 (p >0.05- insignificant)

**4:- COMPARISON OF DURATION OF SURGERY (DOS):-**

Only one (4%) patient of SILC group was operated during the time interval of 20-39 minutes while in cLC group 13(52%) were operated during the similar time interval. During 40-59 minutes of time interval 16(64%) patients in SILC group had undergone surgery while in cLC group 12(48%) patients were

operated in this time interval. In 60-79 minutes of time duration 8 (32%) of the patients were operated in SILC group while the entire patient in cLC group had been operated before this time interval. The mean time for the duration of surgery was 53.32 min in SILC group and in cLC group mean operating time was 39.40min, with p value 0.001 ,showing that the operating time in

the SILC group was significantly high as compared to the cLC group. (table 4)

**Table 4:- COMPARISON OF DURATION OF SURGERY (DOS):-**

Time (in minutes)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
20-39	1	4	13	52
40-59	16	64	12	48
60-79	8	32	0	0
<b>MEAN</b>	53.32		35.20	

p value= <.001 (p <0.05- significant).

**5:- COMPARASION OF TLC ( BASE LINE)**

The pre operative TLC of these patients ranged from 4.78 m/mm<sup>3</sup> to 9.56 m/mm<sup>3</sup>. In the SILC group, pre operative TLC ranged from 4.10 m/mm<sup>3</sup> to 8.80 m/mm<sup>3</sup> and the mean was 6.286±1.147 m/mm<sup>3</sup>(standard deviation) . In the cLC group, pre operative TLC ranged from 4.38 m/mm<sup>3</sup> to 9.36 m/mm<sup>3</sup> and the mean was 6.654±1.569 m/mm<sup>3</sup>(standard deviation). The p value for pre operative TLC between OC and LC groups was 0.349. (Tables 5)

**Table 5:- COMPARASION OF TLC ( BASE LINE)**

TLC (in m/mm)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
4.00-7.90	24	96	19	76
8.00-11.00	1	4	6	24
>11.00	0	0	0	0
<b>MEAN</b>	6.286		6.654	

p value= 0.349, which is insignificant.

**6 :- COMPARASION OF TLC (WITH IN 6 HOURS)**

TLC with in 6 hours ranged from 4.2 m/mm<sup>3</sup> to 11.63 m/mm<sup>3</sup> . In the SILC group, mean was 7.106±2.361 m/mm<sup>3</sup>(standard deviation). In the cLC group, TLC ranged from 2.2 m/mm<sup>3</sup> to 12.00 m/mm<sup>3</sup> and the mean was 9.991±14.547 m/mm<sup>3</sup>(standard deviation) .The p value for TLC between SILC and cLC groups was 0.333. (Table 6) .

**Table 6 :- COMPARASION OF TLC (WITH IN 6 HOURS)**

TLC (in m/mm)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
4.00-7.90	19	76	19	76
8.00-11.00	4	16	5	20
>11.00	2	8	1	4
<b>MEAN</b>	7.106		9.991	

p value =0.333 ,which is insignificant.

**7 :- COMPARASION OF TLC (WITH IN 24 HOURS)**

TLC on 1<sup>st</sup> post operative day (24 hours after surgery) of these patients ranged from 4.4 m/mm<sup>3</sup> to 12.2 m/mm<sup>3</sup>. In the SILC group, mean was 7.554±3.196 m/mm<sup>3</sup>(standard deviation) .In the cLC group, the mean was 7.122±2.351 m/mm<sup>3</sup>(standard deviation) .

Number of patients were 25 in each group .Majority of patients had TLC between 4.00 -7.90m/mm<sup>3</sup> .i.e. 56 % and 64% in SILC and cLC group respectively .The p value for TLC on 1<sup>st</sup> post operative day between SILC and cLC groups was 0.589.(Table 7).

**Table 7 :- COMPARASION OF TLC (WITH IN 24 HOURS)**

TLC (in m/mm)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
4.00-7.90	15	56	16	64
8.00-11.00	9	36	8	32
>11.00	2	8	1	4
<b>MEAN</b>	7.554		7.122	

p value = 0.589 ,which is insignificant.

**8 :- COMPARASION OF TLC (WITH IN 48 HOURS)**

TLC on 2<sup>nd</sup> post operative day (48 hours after surgery) of these patients ranged from 4.3 m/mm<sup>3</sup> to 12.8 m/mm<sup>3</sup> . In the SILC group, mean was 8.923±2.165 m/mm<sup>3</sup>(standard deviation). In the cLC group, mean was 7.339±2.776 m/mm<sup>3</sup> (standard deviation). Number of patients were 25 in each group .Majority of patients had TLC between 4.00 -7.90m/mm<sup>3</sup> .i.e. 52 % in cLC group. In SILC group,majority of patients had TLC between 8.00 -11.00m/mm<sup>3</sup> .i.e. 52 %.The p value for TLC on 2<sup>nd</sup> post operative day between SILC and cLC groups was 0.029. (Table 8).

**Table 8 :- COMPARASION OF TLC (WITH IN 48 HOURS)**

TLC (in m/mm) <sup>3</sup>	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
4.00-7.90	8	32	13	52
8.00-11.00	13	52	11	44
>11.00	4	16	1	4
<b>MEAN</b>	8.923		7.339	

p value= 0.029, which is insignificant.

**9 :-COMPARASION OF CRP (BASELINE)**

The pre operative CRP of these patients ranged from 2 mg% to 5 mg%. In the SILC group, pre operative CRP was < 5 mg% . In the cLC group, pre operative CRP was also < 5 mg% .The p value for pre operative CRP between SILC and cLC groups was insignificant.

**Table 9 :-COMPARASION OF CRP (BASELINE)**

CRP (in mg/dl)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
<5	25	100	25	100
6- 10	0	0	0	0
>10	0	0	0	0

p value in 1.00 , insignificant.

**10 :- COMPARASION OF CRP (WITH IN 6 HOURS)**

CRP with in 6 hours ranged from 5 mg% to 48 mg% .In the SILC group, CRP mean was 22.98±17.55 mg%(standard deviation ). In the cLC group, CRP mean was 20.58±22.6 mg%(standard deviation). Number of patients were 25 in each group .Majority of patients had CRP value below 5 mg% i.e. 80 % and 60% in SILC and cLC group respectively. The p value for CRP between SILC and cLC groups was 0.854. (Table 10) .

**Table 10 :- COMPARASION OF CRP (WITH IN 6 HOURS)**

CRP (in mg/dl)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
<5	20	80	15	60
6- 10	01	4	2	8
11- 20	03	12	2	8
>20	01	4	6	24
<b>MEAN</b>	22.98		20.58	

p value =0.854, which is insignificant.

**11 :- COMPARASION OF CRP (WITH IN 24 HOURS)**

CRP on 1<sup>st</sup> post operative day (24 hours after surgery) of these patients ranged from 5 mg% to 120 mg% . In the SILC group, CRP mean was 47.10±33.28 mg% (standard deviation ). In the cLC group, CRP mean was 45.40±28.54 mg%(standard deviation ). Number of patients were 25 in each group .Majority of patients had CRP value more than 20 mg% i.e. 60 % and 76% in SILC and cLC group respectively. The p value for CRP at 1<sup>st</sup> post operative day (24 hours after surgery) between SILC and cLC groups was 0.854. (Table 11).

**Table 11 :- COMPARASION OF CRP (WITH IN 24 HOURS)**

CRP (in mg/dl)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
<5	3	12	2	8
6- 10	2	8	0	0
11- 20	5	20	4	16
>20	15	60	19	76
<b>MEAN</b>	47.10		45.40	

p value =0.854 ,which is insignificant.

**12 :- COMPARASION OF CRP (WITH IN 48 HOURS)**

CRP on 2<sup>nd</sup> post operative day (48 hours after surgery) of these patients ranged from 6.2 mg% to 120 mg% . In the SILC group, CRP mean was 61.98±37.06 mg%. In the cLC group, CRP mean was 65.08±39.6 mg%. Number of patients were 25 in each group .Majority of patients had CRP value more than 20 mg% in each group i.e. 80 % in both SILC and cLC group. The p value for CRP at 2<sup>nd</sup> post operative day between SILC and cLC groups was 0.781 .(Table 12).

**Table 12 :- COMPARASION OF CRP (WITH IN 48 HOURS)**

CRP (in mg/dl)	SILC GROUP		cLC GROUP	
	No. of patients (n =25)	%Age	No. of patients (n =25)	%Age
<5	1	4	1	4
6- 10	1	4	2	8
11- 20	3	12	2	8
>20	20	80	20	80
<b>MEAN</b>	61.98		65.08	

p value = 0.781, which is insignificant.

**IX. DISCUSSION**

Laparoscopic cholecystectomy (three or four trocars) is known to be a gold standard for cholecystectomy<sup>9,10</sup>. As a result of development of new surgical technique and highly sophisticated technologies, surgical approach to gallbladder has tendency to become less invasive by reducing number and size of operative ports and instruments<sup>9,11,12</sup>; with intention of less postoperative pain, shorter hospitalization time and better cosmetic results. Single-incision laparoscopic (SILC) cholecystectomy is a step toward these objectives, because it cannot be overstated that every incision and trocar placement poses a risk of bleeding, organ damage and incisional hernia.<sup>12,13</sup>

CRP and TLC are well known systemic stress factors. In order to understand more about the impact of stress factors like C- reactive protein and total leucocyte count during the surgery and after the surgery, study was conducted in IGMC, shimla. In this study 25 patients who underwent cLC were compared with 25 patients who underwent SILC. The patients in reference to variables such as age, height, weight or BMI were similar in the two different groups of cLC and SILC .

The aim of this study was to compare single incision laparoscopic cholecystectomy with 4 port laparoscopic cholecystectomy in terms of preoperative and post operative CRP and TLC at different time intervals and to look for any significant difference between these two groups.

**1. AGE DISTRIBUTION IN SINGLE INCISION AND 4PORT LAPAROSCOPIC CHOLECYSTECTOMY GROUP:-**

The age of patients included in the study ranged from 15 years to 58 years. The mean age was 30.8 years in the SILC and 35.40 years in cLC group respectively, which is statistically insignificant (p value=.095).

Rasic Zaraco et al 2010<sup>14</sup>, in his study conducted to compare SILC and cLC also has shown no significant age difference.

**2. SEX DISTRIBUTION:-**

In the present study 86% of the total patients were females and 14 % were males (Table 2, Figure 2). There was 1 male (4%) and 24 females (96%) in the SILC and 6 males (24%) and 19 females (76%) in the cLC group. The study of H. Rivas et al<sup>60</sup> in which 80 women (85%) and 15 men (15%) were included in SILC group and female to male ratio was 16:3.

The study conducted by Roland Raakow et al<sup>15</sup> had included 142 women (65%) and 78 (35%) men. Of all the above cited studies it has been supported the fact that gall stones are more common in females.

**3. BASAL METABOLIC INDEX (BMI):-**

The BMI ranged from 18 to 30 kg/m<sup>2</sup> . Mean was 21.04 in the SILC and 21.88 in the cLC group respectively. The p value was >0.206 which was statistically insignificant. (table3).

The BMI in the study of Asakuma et al<sup>16</sup> was 22+-2kg/m<sup>2</sup> in both SILC and 4 port LC group.

Study conducted by Dragon schwartz et al<sup>17</sup> , in 2010 have shown no significant difference in BMI in SILC and cLC.

#### 4. COMPARISON OF DURATION OF SURGERY (DOS):-

Only 1 (4%) patient of SILC group was operated during the time interval of 20-39 min while in 4port LC group 13 (52%) were operated during the similar time interval. During 40-59 min of time interval 16(64%) patients in SILC group had undergone surgery while in 4port LC group 12(48%) patients were operated in this time interval. In 60-79 min of time duration 8(32%) of the patients were operated in SILC group while all the patient in 4port LC group had been operated before this time interval. The mean time for the duration of surgery was 53.32min in SILC group and in 4port LC group mean operating time was 39.40min, showing that the mean operating time in the SILC group was significantly high as compare to the 4port LC group. P value= <.001 (p <0.05- significant).

The study conducted by Evangelos C. Tsimoyiannis et al<sup>18</sup> had found Mean operative time  $37.3 \pm 9.16$  min in 4 port LC and  $49.65 \pm 9.02$ min in SILC. Thus, the results of the present study are similar to that reported above in the manner that total duration of surgery in SILC group is more than that in the cLC group.

Zaraco et al 2010<sup>14</sup>, in his study conducted to compare SILC and cLC also has shown no significant difference in terms of duration of surgery .It was 46 min in SILC and 43 min in cLC

#### 5. PRE OPERATIVE TLC

The mean pre operative TLC in the SILC group, the mean was  $6.286 \pm 1.147$  m/mm<sup>3</sup> whereas in the cLC group, the mean pre operative TLC was  $6.654 \pm 1.569$  m/mm<sup>3</sup>. The result was comparable in both the groups (p = 0.395). which is insignificant

Wright VJ et al<sup>19</sup> also compared systemic stress response in the form of TLC pre and post operatively and found no significant difference between SILC and cLC.

#### 6. TLC WITH IN 6 HOURS:-

TLC with in 6 hours ranged from 4.2 m/mm<sup>3</sup> to 11.63 m/mm<sup>3</sup>. In the SILC group, mean was  $7.106 \pm 2.361$  m/mm<sup>3</sup>. In the cLC group, TLC ranged from 2.2 m/mm<sup>3</sup> to 12.00 m/mm<sup>3</sup> and the mean was  $9.991 \pm 14.54$  m/mm<sup>3</sup>. The p value for TLC between SILC and cLC groups was 0.333. (Table 6).

Darzi et al 2011<sup>20</sup> also compared systemic stress response in the form of TLC pre and post operatively and found no significant difference between SILC and cLC.

#### 7.COMPARASION OF TLC (WITH IN 24 HOURS)

TLC on 1<sup>st</sup> post operative day (24 hours after surgery) of these patients ranged from 4.4 m/mm<sup>3</sup> to 12.2 m/mm<sup>3</sup>. In the SILC group, mean was  $7.554 \pm 3.196$  m/mm<sup>3</sup>. In the cLC group, the mean was  $7.122 \pm 2.351$  m/mm<sup>3</sup>. The p value for TLC on 1<sup>st</sup> post operative day between SILC and cLC groups was 0.589. (Table 7).

As shown by p value there is no significant difference between both groups.

#### 8. COMPARASION OF TLC (WITH IN 48 HOURS)

TLC on 2<sup>nd</sup> post operative day (48 hours after surgery) of these patients ranged from 4.3 m/mm<sup>3</sup> to 12.8 m/mm<sup>3</sup>. In the SILC group, mean was  $8.923 \pm 2.165$  m/mm<sup>3</sup>. In the cLC group, mean was  $7.339 \pm 2.776$  m/mm<sup>3</sup>. The p value for TLC on 2<sup>nd</sup> post

operative day between SILC and cLC groups was 0.029. (Table 8 ).  
pvalue= 0.290, which is insignificant.

Same finding was supported by McGregor et al ,2011 in his study<sup>7</sup>.

#### 9.COMPARASION OF CRP (BASELINE)

The pre operative CRP of these patients ranged from 2 mg% to 5 mg%. In the SILC group, pre operative CRP was ,< 5 mg% . In the cLC group, pre operative CRP was also < 5 mg% . As all values were < 5 mg% , so p value for pre operative CRP between SILC and cLC groups was insignificant.

#### 10. COMPARASION OF CRP (WITH IN 6 HOURS)

CRP with in 6 hours ranged from 5 mg% to 48 mg% .In the SILC group, CRP mean was  $22.9 \pm 17.55$  mg%. In the cLC group, CRP mean was  $20.58 \pm 22.6$  mg%. The p value for CRP between SILC and cLC groups was 0.854. (Table 10) .

McGregor et al 2011<sup>7</sup>, measured CRP,TLC and IL-6 after gall bladder removal in both groups i.e. SILC and cLC and found no significant difference in both these groups.

#### 11. COMPARASION OF CRP (WITH IN 24 HOURS)

CRP on 1<sup>st</sup> post operative day (24 hours after surgery) of these patients ranged from 5 mg% to 120 mg% . In the SILC group, CRP mean was  $47.10 \pm 33.23$  mg%. In the cLC group, CRP mean was  $45.40 \pm 28.54$  mg%. The p value for CRP at 1<sup>st</sup> post operative day (24 hours after surgery) between SILC and cLC groups was 0.854. (Table 11).

Froghi et al (2011)<sup>21</sup> reported that serum IL-6, TNF- $\alpha$ , CRP and TLC levels were not significantly different in the SILC and 4PLC groups at baseline and at six , 24 hours and 48 hours after surgery (p>0.05 for all).

#### 12 . COMPARASION OF CRP (WITH IN 48 HOURS)

CRP on 2<sup>nd</sup> post operative day (48 hours after surgery) of these patients ranged from 6.2 mg% to 120 mg% . In the SILC group, CRP mean was  $61.98 \pm 37.06$  mg%. In the cLC group, CRP mean was  $65.08 \pm 39.6$  mg%. The p value for CRP at 2<sup>nd</sup> post operative day between SILC and cLC groups was 0.781 .(Table 12).

Two studies compared the surgical stress response in SILC and 4PLC patients by measuring biochemical stress markers including IL-6, TNF- $\alpha$ , CRP and TLC, six and 24 hours after surgery (Froghi et al 2011; McGregor et al 2011). Froghi et al (2011) reported that serum IL-6, TNF- $\alpha$ , CRP and TLC levels were not significantly different in the SILC and 4PLC groups at baseline and at six and 24 hours after surgery<sup>21</sup> .

Similarly, McGregor et al (2011)<sup>7</sup> reported that serum IL-6 and CRP levels were not significantly different in the SILC and 4PLC groups at baseline and at 6 ,24 and 48 hours after surgery (p>0.05 for all).

#### X. SUMMARY

The present study was carried out in the Department of Surgery, IGMC, Shimla over a period of 12 months from 1<sup>st</sup> July 2012 to 30<sup>th</sup> June 2013 on 50 patients who were admitted with

clinical diagnosis of symptomatic cholelithiasis. The following observations were made:-

1):- The age of patients included in the study ranged from 15 years to 58 years with mean age of 39.45 years. The mean age was 30.8 years in the SILC and 35.40 years in cLC group respectively, which is statistically insignificant ( $p$  value = 0.095).

2):- In the present study 86% of the total patients were females and 14% were males. There was 1 male (4%) and 24 females (96%) in the SILC and 6 males (24%) and 19 females (76%) in the cLC group. The data shows that cholelithiasis is more common among females.

3):- The BMI ranged from 18 to 30 kg/m<sup>2</sup> with mean BMI of 21.44. It was 21.04 in the SILC and 21.88 in the cLC group respectively. The  $p$  value is >0.206 which is statistically insignificant.

4):- The total duration of surgery was more in the SILC group as compared to cLC group. The mean time for the duration of surgery was 53.40 min in SILC group and in 4port LC group mean operating time was 39.80 min, showing that the mean operating time in the SILC group was significantly high as compared to the 4port LC group.  $P$  value = <.001 ( $p$  <0.05-significant).

5):- As expected, the preoperative levels of the TLC and CRP were comparable in the two groups.

6):- Mean of TLC within 6 hours in SILC group was  $7.106 \pm 2.361$  m/mm<sup>3</sup> whereas in the cLC group, mean was  $9.991 \pm 14.54$  m/mm<sup>3</sup>. The  $p$  value for TLC between SILC and cLC groups was 0.333.

7):- TLC on 1<sup>st</sup> post operative day (24 hours after surgery) of these patients ranged from 4.4 m/mm<sup>3</sup> to 12.2 m/mm<sup>3</sup>. In the SILC group, mean was  $7.554 \pm 3.196$  m/mm<sup>3</sup>. In the cLC group, the mean was  $7.122 \pm 2.351$  m/mm<sup>3</sup>. The  $p$  value for TLC on 1<sup>st</sup> post operative day between SILC and cLC groups was 0.589. As shown by  $p$  value there is no significant difference between both groups.

8):- TLC on 2<sup>nd</sup> post operative day (48 hours after surgery) of these patients ranged from 4.3 m/mm<sup>3</sup> to 12.8 m/mm<sup>3</sup>. In the SILC group, mean was  $8.923 \pm 2.165$  m/mm<sup>3</sup>. In the cLC group, mean was  $7.339 \pm 2.776$  m/mm<sup>3</sup>. The  $p$  value for TLC on 2<sup>nd</sup> post operative day between SILC and cLC groups was 0.029.

9):- The pre operative CRP in both groups were <5 mg% , so  $p$  value for pre operative CRP between SILC and cLC groups was insignificant.

10):- CRP within 6 hours ranged from 5 mg% to 48 mg%. In the SILC group, CRP mean was  $22.9 \pm 17.55$  mg%. In the cLC group, CRP mean was  $20.58 \pm 22.6$  mg%. The  $p$  value for CRP between SILC and cLC groups was 0.854.

11):- CRP on 1<sup>st</sup> post operative day (24 hours after surgery) of these patients ranged from 5 mg% to 120 mg%. In the SILC group, CRP mean was  $47.19 \pm 33.28$  mg%. In the cLC group, CRP mean was  $45.40 \pm 28.54$  mg%. The  $p$  value for CRP at 1<sup>st</sup> post operative day (24 hours after surgery) between SILC and cLC groups was 0.854.

12):- CRP on 2<sup>nd</sup> post operative day (48 hours after surgery) of these patients ranged from 6.2 mg% to 120 mg%. In the SILC group, CRP mean was  $61.98 \pm 37.06$  mg%. In the cLC

group, CRP mean was  $65.08 \pm 39.6$  mg%. The  $p$  value for CRP at 2<sup>nd</sup> post operative day between SILC and cLC groups was 0.781.

## XI. CONCLUSION

Recent developments in laparoscopic surgery have led to single incision laparoscopic surgery technique, in which instead of several ports placed throughout the abdomen only one entry site into the abdominal cavity is used. Moreover, with fewer abdominal incisions it seems justified to expect reduced wound related complications and less postoperative pain as well as better patient satisfaction with cosmetic outcome.

In this study 50 patients were taken and they had all variables similar i.e age, BMI as shown in the study.

As SILC is comparatively newer technique in the world of minimal access surgery and it has its learning curve, so SILC took longer operative time than the cLC. We can say that as the experience increases with the SILC procedure the operative time will decrease.

Moreover, in this study, SILC was done with conventional instruments which are used for cLC.

In this study, no significant statistical difference were found in systemic stress factors i.e. CRP and TLC pre and post operatively in either of groups (SILC and cLC).

Hence based on the comparative evidence presented in this study, SILC appears to be as safe, effective and feasible technique and good alternative to cLC with potential advantages of cosmesis. The costs associated with SILC and cLC procedures appear similar. Ultimately, the decision as to whether to perform SILC or traditional/conventional LC will be dependent on the preferences of individual surgeons and patients.

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# Effect of Militancy on Sports and Games in Kashmir in Jammu and Kashmir State

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**Abstract-** Kashmir is known as paradise on earth. The valley of Kashmir well-known for its beauty and celebrity is a theme well worthy of a poet. Nowhere in Asia, nor even in the remaining quarters of the globe, can the parallel be found of such an earthly paradise, a paradise in itself but made doubly beautiful by its surroundings. Sports and Tourism constitutes one of the main sources of income for vast sections of Kashmiri population. The sports sector received a serious jolt with the outbreak and spread of militancy from 1989 onwards. Sports industry of Kashmir valley suffered tremendously due to violent militant activities. Once militancy gained momentum the sports in the valley declined substantially. In this study only period of 10 years (2006-2015) were considered. It was shown in the study that due to disturbance in Kashmir in year 2008, 2009 and 2010 the participants show decline in number almost 15.27% and in the year 2014 and 2015 when there was decline in the militancy there was gradual increase in the participants almost 26.6% in the Kashmir valley.

**Index Terms-** Militancy, Games, Sports, State

## I. INTRODUCTION

**W** "Who has not heard of the value of cashmere  
With its roses the brightest that earth ever gave,  
Its temples, and grottos, and fountains as clear  
As the love-lighted eyes that hang over their wave?"  
(Lalla Rookh, Thomas Moore)

History bears witness to the fact that whenever and wherever militancy found roots, the economy of that region became a major casualty. This is true for the Kashmir region as well since 1989. In the seventh plan period a special outlay of Rs. 22.06 cores was made available for the development of the tourism sector. The result was that the tourist inflow made considerable upward movement in mid-eighties of the last century. However, with militancy in the state and engulfing the valley of Kashmir from 1989 onwards the tourist trade completely collapsed. The border tensions notwithstanding,

On the other hand the Indian Army is organizing a cricket tournament to promote budding cricketers from "far flung areas" in Jammu and Kashmir. A total of six teams were taking part in the Rashtriya Rifles Big Bash (RRBB) Intra Village Cricket Tournament in Jammu region, a statement from the military said Thursday. The teams have been drawn from the Naushera subdivision. The game will be played on 20:20 league-cum-knockout basis. "The tournament has witnessed an overwhelming response and has turned out to be a crowd puller." "The youth and locals of the area were extremely happy since it

also diverted their attention from the devastation caused by the floods... With reputation at stake, each team put in their best." Militants not only attacked and disturbed Kashmir but international militants also attacked international sports activities also. Between the 1972 attack at the Munich Olympic Games and 2003 there were an estimated 168 different realized and thwarted terrorist acts around the world targeting sports events. Some of these events include:

**1972 Munich, Germany.** The Palestinian militant group Black September took the Israeli national team hostage during the 1972 Munich Olympic Games. After a 16-hour stand-off and failed rescue all 11 athletes and coaches, one German police officer, and all of the attackers were confirmed dead.

**1986 Amsterdam, The Netherlands.** A bomb exploded at the headquarters of the 1992 candidature committee in Amsterdam, allegedly the responsibility of the 'Into the Blue Commando of the Revolutionary Cells' in a protest against Amsterdam's bid for the 1992 Games. There were no casualties.

**1987 South Korea.** Korean Air Flight 858 was destroyed in flight when a bomb hidden in an overhead compartment was detonated. All 104 passengers and 11 crew were killed. The attack was designed, in part, to disrupt the lead up to the 1988 Seoul Olympic Games.

**1996 Atlanta, USA.** Eric Rudolph planted a knapsack with three bombs underneath a bench in the Centennial Olympic park at the 1996 Atlanta Olympic Games. Two people were killed and 120 injured when the blast went off.

**1997 Liverpool, UK.** The Grand National horse race was evacuated after two coded bomb threats were reportedly received from the IRA but no spectators were hurt. The event took place two days later.

**1997 Sweden.** Two bomb and several arson attacks around Stockholm, which damaged stadiums and other sports facilities, occurred in August/September. The group claiming responsibility were aiming to disrupt/oppose Sweden's proposal to host the 2004 Olympic & Paralympic Games.

**2002 Karachi, Pakistan.** The New Zealand national cricket team's hotel was targeted by a suicide bomber, killing 11 French navy experts, two Pakistanis, and the team's physiotherapist.

**2002 Madrid, Spain.** E.T.A., a Basque separatist group, detonated a car bomb close to Madrid's main stadium just hours before the start of Real Madrid's Champions League semi-final match against Barcelona. 17 people were injured. A bomb threat in 2004 also forced Real Madrid's match against Real Sociedad to be abandoned.

**2006 Iraqi Olympic Team.** In the lead up to the 2006 Olympic Games the Iraqi team were targeted three times. On 17 May, 15 taekwondo athletes and staff members were kidnapped

while travelling to a competition in Jordan. They were never released or heard from again. On 26 May, the Iraq tennis coach and two players were killed by gunmen. Lastly, on 15 July, the head of the Iraqi Olympic Committee and 37 officials and athletes were kidnapped. Of these, only 13 were seen again.

**2008 Waliweriaya, Sri Lanka.** A dozen people were killed and almost 100 injured when a suspected Tamil Tiger suicide bomber detonated an explosion at the start of the New Year Marathon.

**2008 Mauritania.** The Dakar Rally was cancelled due to a security threat from al Qaeda. The decision was based on safety warnings from the French government and threats received directly by the race organizers. When the rally resumed in 2009 it was moved to South America.

**2009 Lahore, Pakistan.** Roughly a dozen gunmen with guns, rockets, and grenades attacked the Sri Lankan cricket team bus and their police escorts. Eight people were killed and six injured.

**2010 Cabinda, Angola.** An Angolan separatist group attacked the Togo football team bus at the African Cup of Nations, killing 3 people.

**2010 Pakistan.** A suicide bomber killed at least 105 people and injured over 100 when he drove a vehicle filled with explosives into a community volleyball match in NW Pakistan.

**2010 Africa.** A variety of attacks against crowds of people watching the World Cup occurred in Uganda and Somalia. At least 75 people were killed and over 70 injured in the combined attacks. Responsibility for the Somalia attacks was claimed by the Hizbul Al Islam group who claimed that gathering to watch the World Cup violated Islamic law.

**2013 Boston, USA.** Dzhokhar and Tamerlan Tsarnaev, apparently motivated by extremist Islamic beliefs, set off two pressure cooker bomb devices at the 2013 Boston Marathon. Three spectators were killed and 264 injured.

**2015 Stade du France.** Three suicide bombers detonated devices outside the Parisian Stade de France while France were playing Germany in an international football friendly. 1 bystander and the three bombers were killed. The attack was part of a broader series of coordinated terrorist attacks that killed 130 people and injured 368 in total.

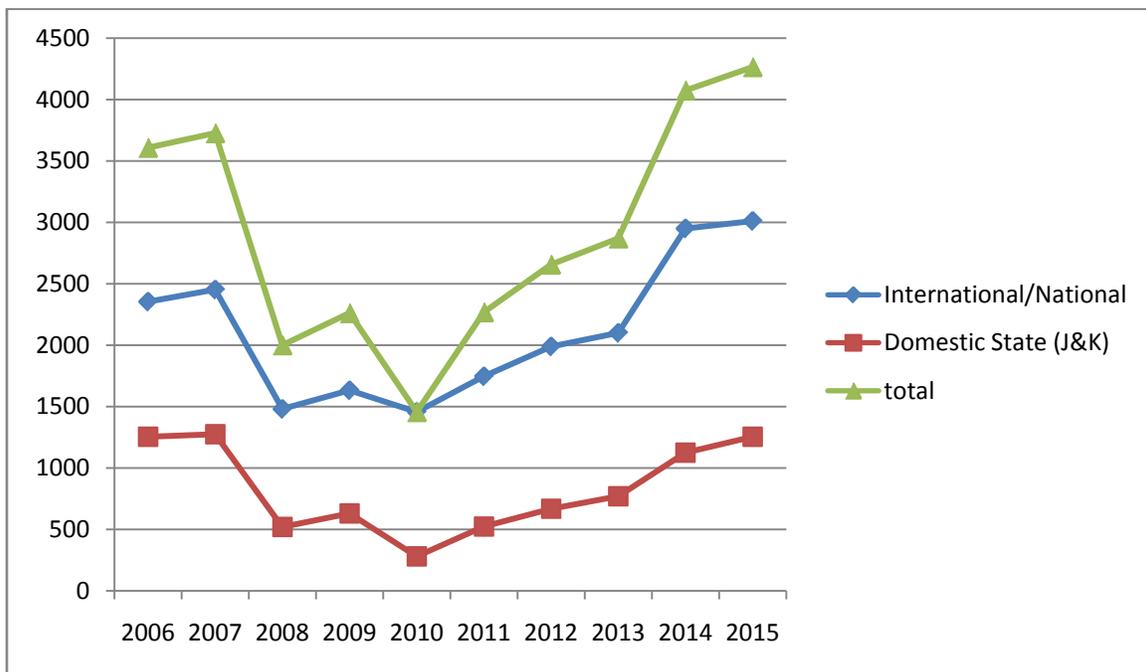
**IMPACT OF MILITANCY ON SPORTS AND GAMES IN KASHMIR**

Sports and Tourism constitutes one of the main sources of income for vast sections of Kashmiri population. Tourist destinations like Sonamarg and Gulmarg are known internationally for winter games such as skiing. Gulmarg is also known as the highest green golf course in the world, and boasts the world's largest cable car lift. Adventure sports include trekking, mountaineering, winter sports, water sports, golf and fishing. However, most of these sports activities remain underdeveloped. It is a stark reality that till late 1980's the state of Jammu and Kashmir used to attract huge numbers of national as well as international players, but the sports sector received a serious jolt with the outbreak and spread of militancy from 1989 onwards. Sports industry of Kashmir valley suffered tremendously due to violent militant activities. Once militancy gained momentum the sports to the valley declined substantially. On the other hand Department of Youth services and sports organizes different tournaments of all games between the students of Kashmir valley. Every year thousands of students participate in games and sports. This study also shows that due to the disturbance in the valley (2008,2009,2010) there is also decline in percentage of sports participants (domestic). When there is normal conditions (normalcy) in the valley(2006,2007, 2013,2014, 2015) there is increase in percentage of sports participations.

**Table: Participation of sports persons in Kashmir from 2006 to 2015.**

Year	Domestic	National/International participants	Total
2006	2354	1254	3608
2007	2452	1275	3600
2008	1480	520	2000
2009	1632	630	2262
2010	1456	280	1800
2011	1746	523	2200
2012	1989	668	2657
2013	2100	770	2870
2014	2950	1125	4075
2015	3011	1254	4265

Source: Director Tourism Kashmir and Department of youth services and sports.



The sports infrastructure created over the years suffered huge damage. The sports industry of the valley could not be maintained and they acquired a shabby and shoddy look. Those engaged with the maintenance and beautification of these sports infrastructure did not discharge their duties since this was internal security and maintenance of law and order. Before the advent of militancy a separate budget was kept for the development of infrastructure and beautification of the sports grounds which performance had to be curtailed for use in counter terrorist activity.

## II. CONCLUSION

Sports has undoubtedly been one of the major sources of income and employment for the people of Kashmir valley. However, the militancy badly impeded the sports lovers and tourist inflow into the valley and the financial conditions of the people suffered heavily. The survey indicated that due to disturbance in Kashmir in year 2008, 2009 and 2010 the participants shows decline in number almost 15.27% and in the year 2006, 2007, 2014 and 2015 when there was decline in the militancy there was gradual increase in the participants almost 26.6% in the Kashmir valley. The enormity of economic damage due to militancy can not be really judged because the of the present conditions in the valley. Now that peace is getting to prevail albeit laboriously, it can only be hoped that the region witnesses no revisit of the dismal years of economic, political, social and developmental stagnant which set back the clock for the progressive people. The department of sports is trying hard to improve the condition of the sports industry in Kashmir Though,

the state government has declared many incentives and facilities for those who are interested to sports, an integrated planning for sustainable development of sports sector needs to be considered. Achievement will be influenced by the degree to which planning for sports culture is integrated both horizontally and vertically. Due to militancy much has been lost but it can be regained and restored only if peace prevails.

***If we want to achieve sports we can't use peace  
 But if we have to achieve peace we can use sports***  
 (Khan Muneer Aslam)

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# Existing *Natural Resources* in North Darfur State & their Potentialities for supporting the Livelihoods of Rural Communities – North Darfur – Sudan

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**Abstract-** The objective of this research is to study the capabilities of the five capitals of sustainable livelihoods in the rural areas of North Darfur state. This is to estimate the different capabilities of those capitals and their potentialities to support the rural peoples. The methodology used in the research is the participatory approach assessment tool the participatory approach assessment tool has emerged as advancement or combination of principles used in the Participatory Rural Appraisal (PRA) and the basic concept of the Sustainable Livelihood Approach (SLA) as it was called by the British Department for International Development (DFID). The methodology used for this survey was through the adoption of group discussion method with the communities in the visited areas in the study area. Semi-structured questionnaires were prepared and used for answering the questions related to this study. Two questionnaires were used in this study. First questionnaire was focused on importance and availability of issues related to livelihood elements, namely, the natural resources, physical resources, human resources, financial resources, and social resources. Second questionnaire was focused on various issues related to use of natural resources, namely, allocation of land for different purposes, main products provided by the forest, types of cultivated crops, average productivity of cultivated crops, farm size, sources of income generating activities, animal holdings, availability of pasture, water sources, etc. The collected data were tabulated and analyzed using excel package to produce tables and graphs. The analyzed data has concluded into a number of findings included: The indicators of livelihood have shown significant gaps between their importance and their availability especially with regard to natural resources, financial resources, physical resources, and human resources. Moreover; the assessment results have indicated, low productivity of food security, limited ownerships of resources related to farming. Deficiency in production of natural resources, this is attributed to small farm holdings, rainfall fluctuations, security concerns, inability of communities to resolve their own problems. In some cases despite the availability of lands, soil fertility, human desire, but the security concerns normally impedes many of them to make use of their resources and eventually get confined in limited areas. Finally detailed discussions about the deficiencies and availabilities of natural resources were presented and specific recommendations were drawn with regard to those issues and their complications in the future.

**Index Terms-** Natural resources – five pillars – Kebkabiya – North Darfur State – Adam Adoma Abdalla– Livelihood – Zeraiga – Dar Al Salam – Kalamendo – Participatory Approach

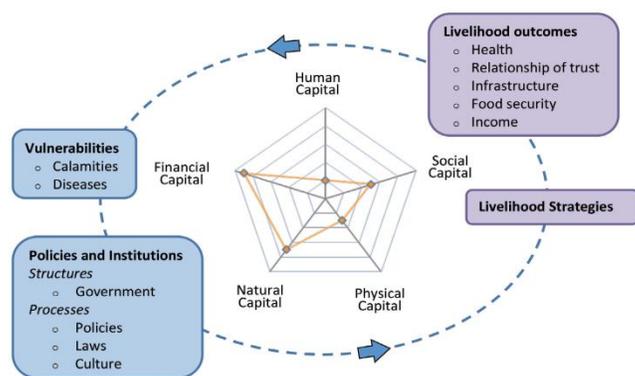
## I. INTRODUCTION

The participatory approach assessment tool has emerged as advancement or combination of principles used in the Participatory Rural Appraisal (PRA) and the basic concept of the sustainable livelihood approach (SLA) as it was called by the British Department for International Development (DFID). The assessment tool was designed for the evaluation of the impact of different natural resource management approaches on a specific target group. The focus lies on local concerns by communities and individuals with regard to natural resource management. According to Chambers (1994) the PRA as a term is being used to describe the growing family of approaches and methods that enable local people to bring in their knowledge and perception into decision making processes (Chambers 1994). The basic idea of the sustainable livelihood approach is based on five pillars, the five livelihood assets are: human capital (HC), Social capital (SC), Physical Capital (PhC), Natural Capital (NC), and Financial Capital (FC).

According to Bebbington (1999) one of the principal reasons why rural people have not been able to improve their livelihood derives from the failure or inability to defend their existing capitals or to turn them into new livelihood sources, e.g. turning FC into natural resource enhancement. Participatory methods offer tools for the required understanding on local level and further serve as a medium within which social values and scientific strategies can be combined (Evans et al. 2006, Wollenberg et al. 2005, Salafsky and Wollenberg 2000).

## Five Capital Assets of Livelihood:

Figure 1: Five capitals of the sustainable livelihood framework:



## II. OBJECTIVES

The overall objective of this assessment is, to identify the nature of the current/potential situation of the natural resources in the three localities (Kabkabiya, Dar El Salam and Kalemindo)) in North Darfur State - Sudan.

1. To explore the current/existed practices of Natural Resources Management mechanisms in the study area.
2. To identify the existed natural resources in the target areas.
3. Strong sustainable solutions recommended
4. Comprehensive NR assessment report produced and shared with stakeholders

## III. RESEARCH METHODOLOGY

As it has been already stated, the chosen participatory tool is a combination of already existent PRA (Participatory Rural Appraisal) methods applied in the context of the SLA (Sustainable Livelihood Approach). The data are gathered through participatory methods mainly consist of two components which differ usually in their character. Measures of products are generally accepted as quantitative numbers (numeric value) whereas values as livelihood perceptions, cultural non-use values and individual options are of qualitative character (categorical values, ordinal and nominal). A value or observation can be described as ordinal if the data can be put in order (e.g. combined with a ranking scale). Ordinal data can be counted and ordered deliberately but cannot be measured specifically. Studying livelihoods starts with the identification of the relevant stakeholders. Though the interpretation of the analyzed indicators can differ depending on the interest of the stakeholder, it is inevitable to identify different stakeholder or focal groups. The selection of the participants within such focal groups should be randomly. The assessment is mainly depending on five livelihood capitals, naming HC, SC, Physical Capital, NC and Financial Capital forming the pillars of the investigating tool for the sustainable development approach, commonly accepted as the livelihood framework. Apparently there are many slightly different variations in definition for the five livelihood capitals.

The checklist of the assessment indicators had been prepared based on the livelihood five capitals. The questionnaire has been prepared based on the checklist indicators. It contained the livelihood five capitals and the main indicators for each capital (varying between three to six indicators for each capital). Each indicator has contained two questions including the importance of the indicator and the availability of the indicator. The answer for each question was given three options as follows: The importance of the indicator:

1. Not important
2. Medium important
3. Very important)

While for the availability of the indicator as follows:

1. Not available
2. Medium available
3. Very available).

The implementation of this tool was based in the focus group discussions attended by different stakeholders in the

community. In order to collect the data related to the status of the natural resources in the community under-study; the researcher starts the process by asking the participants about the first indicator and then opens the gate for an open discussion among the participants; he should allow the participants for debate to come up with consensus answer for every selected indicator for each livelihood capital. The aim of this process is to give the participants in each community the opportunity to rate the importance and availability of each indicator for each livelihood capital. On this regard the participants were given the freedom to debate and come into consensus decision about the level of importance and level of availability of each indicator in their community. Once the process related to data collection is finalized. The next step would be the tabulation of the collected data and placing them in tables for further analysis capable to describe the status of the natural resources in the area under-study in terms of its importance and availability. The analysis of the tabulated data had included using spider-gram technique to represent every single capital rankings. This process of analysis is displaying each focus (importance and availability) separately. Arranging the data separately in one diagram visualizes the discrepancy between the importance and the availability of an indicator. Also frequency diagram was used for a possible frequency distribution of the availability of a capital's rankings. Figure-1 is representing the linkages between the five capitals of livelihood and the indicators of each capital. It should be noted that the indicators for each capital are not fixed to those mentioned, but those are the main ones.

## IV. STUDY AREA

North Darfur State was selected for the purpose of this study for many reasons. Firstly: The majority of the populations drive their livelihood through harnessing the natural resources. Secondly: The whole area has been severely affected by deterioration of natural resources. Thirdly: the area has been described by low rainfall. Fourthly: The majority of the population are facing sever poverty. However, the survey was conducted in three localities in North Darfur namely Kalamendo, Dar Al Salam, Kabkabiya.

### a. SAMPLE SIZE

The sample size was obtained by the following formula:

$$(1) \quad ss = \frac{Z^2 * (p)*(1-p)}{c^2}$$

(2) Sample size =  $ss \div 1 + ((ss-1) \div pop)$ .  
Z = Z value (e.g. 1.96 for 95% confidence level). P = Percentage picking a choice, expressed as decimal (0.5 used for sample size needed). C = Confidence interval, expressed as decimal (e.g., .05 = ±5). pop = Population

The sample size was determined by the desired level of precision. Scientifically, it is known that the degree of precision increases as sample size increases. Also the level of precision can be increased by strata issuing more homogeneous sub-samples (Abdalla, H. S., 2008). Therefore due to homogeneity of the socio-economic characteristic of the agricultural community in North Darfur State and insecurity situation; the researcher

selected twelve focus group discussions (villages) across the study area.

### V. ANALYSIS TECHNIQUES

Once the process related to data collection is finalized. The next step would be the tabulation of the collected data and placing them in tables for further analysis capable to describe the status of the natural resources in the area under-study in terms of its importance and availability. The analysis of the tabulated data shall include using spider-gram technique to represent every single capital rankings. This process of analysis is displaying each focus (importance and availability) separately. Arranging the data separately in one diagram visualizes the discrepancy between the importance and the availability of an indicator. Also frequency diagram shall be used for a possible frequency distribution of the availability of a capital's rankings. Figure-1 is representing the linkages between the five capitals of livelihood and the indicators of each capital. It should be noted that the indicators for each capital are not fixed to those mentioned, but those are the main ones.

### VI. THE RESULTS

**Table 1: Current/Existed Practices of Natural Resources Management: Table-1 Main sources of livelihood in the study area:**

Locality	% of Farmers	% of Herders	Sources of livelihood		
			Farming %	Rearing Animals %	Trading %
Kalamendo	89	56	100	100	90
Dar Al Salam	91	36	86	57	57
Kabkabiya	91	22	100	75	100
Average	90	39	96	80	84

Table 1: is showing the main sources of livelihood of the population in three localities. On average about 90% of the population in the three localities are practicing farming, and about 39% are animal herders as well. The majority of the populations are driving their livelihoods from three main sources, namely farming rearing animal, and trading. The minimum number of herders was observed in Kebkabiya (22%) locality. This was attributed to the fact that about 25% of the populations in the locality are considered as Internally Displaced Persons residing in the urban areas and not rearing animals. Focusing on farming and rearing animals has led into competition over limited natural resources in the area. Latter analysis would explain the types of competition over natural resources and their effects on the livelihood of the population in the study area.

**Table 2: Average Farm Size in the three localities:**

Locality	Average farm size in mukhamas		
	Smallest farm size	Medium farm size	Largest farm size
Kalamendo	2	5	16
Dar Al Salam	1.5	3	5.5
Kabkabiya	0.5	1	1.5
Average	1.5	3	8.5

The farm size per household is determined by various factors namely, potentiality of access to land, financial capabilities, security situation, family size etc.. The farm size was ranged from small, medium, and large. According to this assessment the smallest farm size is 1.5 hectares; medium farm size is three hectares, while the largest farm size is 8.5 hectares. On average about 35% of the populations are cultivating medium farm size, 55% cultivating small farm size, and only 10% are cultivating large farm size. The least farm size was observed to be in Kebkabiya locality. This is also attributed to the fact that many populations were not capable to access their original farms. On the other hand lands in the remote areas were used by animal herders which make it difficult for the farmers to access or to cultivate. This has made concentration of farmers along the wadis in small areas.

**Table 3: Main crops cultivated in the study area:**

Locality	Yield of Main crops in tones per hectare					
	Farme	Mille	Dura	Sesam	Groundnut	Watermelo
Kalamendo	89	0.2	0.72	0.4	0.72	0.38
Dar Al Salam	91	0.4	0.9	0.8	0.63	
Kabkabiya	91	2.0	1.98	12.0	0.45	
Average	90	0.8	1.26	2.4	0.63	0.38

Millet, sorghum, sesame, and groundnut were the main crops cultivated in the area. The yields for these crops were noticed to be very low. Table 3 is indicating the yields of some crops. On average the yield of millet was about 0.8 tons per hectare, 1.26 tones for one hectare of sorghum, and 0.63 tons for one hectare of groundnut. The highest yield per hectare for all these crops was observed to be in Kebkabiya locality. The farmers in Kalamendo and Dar Al Salam have maximized the farm size to compensate the low productivity of crops in those localities. Increasing the farms size has strong link with the availability of grazing for the animals. This is another sign of competition over natural resources. Bearing in mind there are significant number of nomads especially in the locality of Kalamendo. Beside these crops other crops were also cultivated, these are mainly vegetable crops such as tomatoes, potatoes, onions, beans, watermelon, etc.. the importance of these crops are varying from one locality to another. Kebkabiya is quite famous on cultivating vegetable crops. The populations have long history on cultivating these crops. These crops are cultivated along the wadis under irrigation using pumps for lifting water. Nevertheless; many farmers are complaining about the intervention of animals before the completion of the harvest season. This risk has even led into elimination of late-maturity

crops from the crop combination in the area. The farmers in Dar Al Salam are also harnessing the banks of the wadis for cultivation of vegetable crops. But the concentration of these crops was observed in Shangil Tobay in the western part of Dar Al Salam locality.

**Table 4: The Soil quality and Land fertility:**

Locality	Soil qualities	
	Medium quality	High quality
Kalamendo	60%	40%
Dar Al Salam	29%	71%
Kabkabiya	25%	75%
Average	40%	60%

The communities were asked to evaluate the fertility of their farmlands according to their experiences if it is very poor in terms of fertility, medium quality, or very fertile. On average about 40% of the communities were informed that the soil fertility of their farmlands were classified as medium quality, while 60% have classified their farmlands as high quality. This information indicates that the soil quality is not one of the problems facing the population in the study area.

**Table 5: Land allocation and Land use:**

Locality	Percentages of Land allocation in each		
	Farming	Grazing	Forest
Kalamendo	43	52	34
Dar Al	67	31	8
Kabkabiya	36	54	33
Average	48	48	28

The communities have been interviewed about the average allocation of their area land for different purposes. On average according to perception of those communities about 48% of the land in their respective areas was used for farming, also 48% of the land was used for grazing of their animals. But only 28% of their lands were considered as forest lands. However; this allocation is different from one locality to another locality.

Figure-2 is indicating that the Dar Al Salam is the poorest in terms of forest availability, while Kalamendo is the richest locality in terms of grazing and forests. This is mainly due to concentration of the population in the urban areas due the recent conflict in Darfur. But the most important element to be noticed is the tremendous decreasing of forests in Kalamedo and Dar Al Salam localities.

Figure 1 is indicating the land use for the three communities (localities) under study.

**Table 6: Forest Products:**

Locality	Percentages of communities		Availability of forest products	
	Gum Arabic	Firewood/building	Grazing	Fruits
Kalamendo	100	100	60	40
Dar Al	29	86	0	29
Kabkabiya	0	100	100	63

Average	48	96	56	44
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The forests are very important component for the livelihood of the rural communities. Table-6 is showing the percentage of communities who claimed the products provided by their forests. Communities in the three localities were interviewed about the availability of forest products in their respective areas; on average about 48% of the communities have perceived that the forests are providing them with Gum Arabic. The majority (96%) of population in the three localities are informed about their dependence on the forests for firewood and building materials. About 44% of the communities have informed that forests are providing their communities with fruits for their own consumption and marketing purposes

**Table 7: Animal Holdings:**

Locality	Percentage of households with different animal Species			
	Cattle	Sheep	Goats	Camels
Kalamendo	90	90	90	20
Dar Al	71	86	86	0
Kabkabiya	80	79	96	75
Average	80	85	91	32

This table indicates the ownership of different animal species, but does not indicate the number of animals per household. The average holding within the IDPs communities is very minimal

Table 7 is showing the ownership of animal holdings by different communities. On average about 80%, 85%, 91%, and 32% of the communities have claimed the ownership of cattle, sheep, goats, and camels respectively. This does not indicate the number of animals per household, but it indicates the ownership of particular animal species by each community. This also indicates the availability of animal species and potentiality of competition over natural resources in case of resource scarcity. In this regard in Kebkabiya locality 100% of communities own cattle, sheep, goats and 75% own camels. Therefore the potentiality of competition over natural resources related to animal needs is very high.

**Table-8 Main water sources in the study area:**

Locality	Percentage of main water sources in the three localities					
	Borehole	Deep wells	Shallow wells	Hand pumps	Dams/ canals	Other
	80	10	0	10	40	10
Dar Al	71	0	0	43	86	0
	0	13	88	88	0	0
Average	52	8	28	44	40	4

Table 8 is showing the main sources of water in the study area. The research has shown the diversification of water sources in the study area. However; the available water for human or animal use is remained as one of the major problems facing most of the population in the study area.

**Figure 2: Water point in Abu Zeraiga village**



**Figure 2: is showing the people queuing in Abu Zeraiga village in Dar Al Salam locality for getting water.**

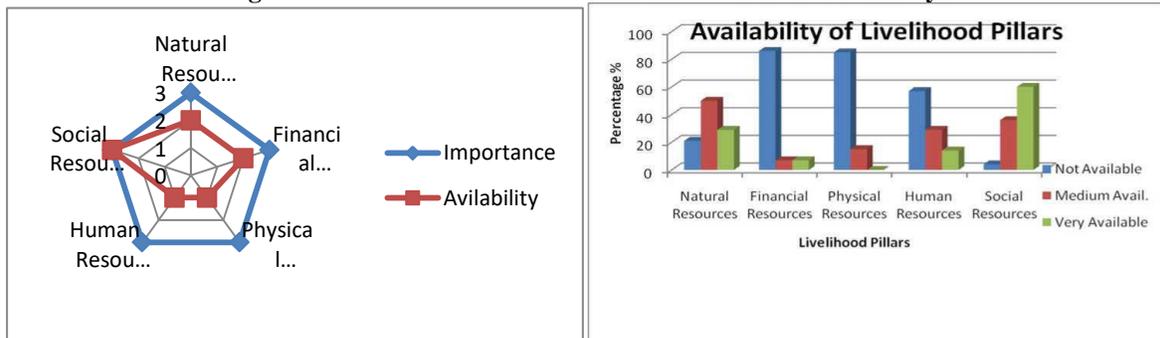
different livelihood pillars in each locality; it is recommended to combine reading spider chart and the frequency diagram for each locality.

Spider chart is normally indicating the general importance of the livelihood element and to what extent it is available in the area. While the frequency diagram is showing the perception of community about the availability of the livelihood element in the study area; it gives the percentage of the community who evaluated the availability if it is not available at all or moderately available, or very abundant. Given the possible differences between the localities in terms of the availability of the livelihood elements; the analysis was focused in each locality independently.

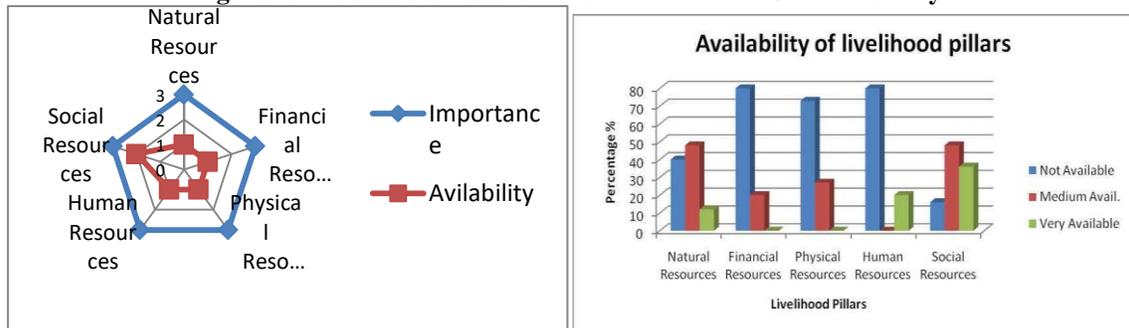
**Status of livelihood elements in the study area:**

Further analysis was focused on the five pillars described as the five capitals of the livelihoods for the population. These are namely the Human Capital, Financial Capital, Social capital, Natural Capital, and Physical C. Different localities have showed acquisition of different levels of the aforementioned capitals. However; the variations was not so significant, most of the localities are sharing similar characteristics of these capitals. Figure-1 to figure-8 are showing the perception of the communities about the livelihood pillars. For understanding the perception of the communities regarding the availability of the

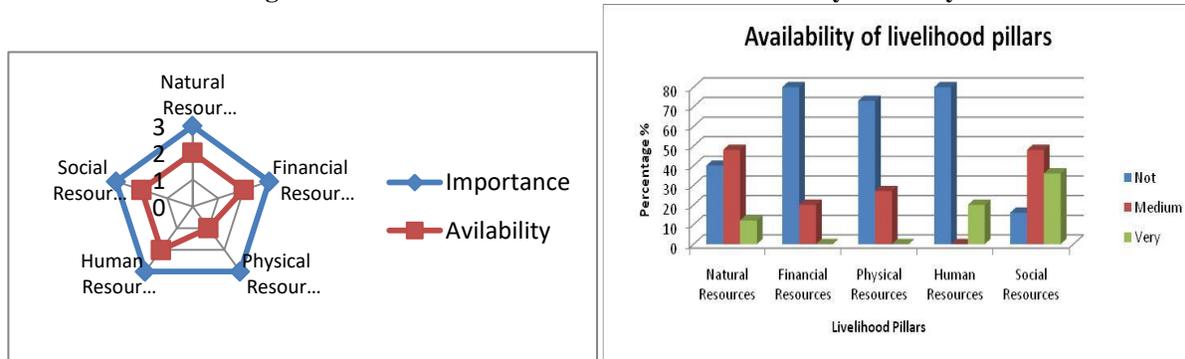
**Figure 3. The status of natural resources in Kalamendo locality:**



**Figure 4. The status of natural resources in Dar Al Salam Locality:**



**Figure 5. The status of natural resources in Kebkabiya Locality**



The line in blue color is indicating the importance of the livelihood element, while the line in red color it's availability. The area in between is indicating the gap in the specific livelihood element.

Figure 3 has shown the livelihood elements status in Kalamendo locality. The assessment has shown significant gaps in the availability of most of the livelihood elements pillars; this is with exception to social resources which seems to be well available compared to other livelihood elements. Figure 3 has indicated approximately 80% of the communities have stated the deficiency of natural, financial, physical, and human resources in their areas and less than 20% of the communities who have stated the availability of the aforementioned resources in their areas. It has been clearly indicated the availability of social resources in the locality of Kalamendo. Nearly 60% of the communities have stated the abundance of social resources in this locality compared to less than 5% who stated the deficiency of social resources.

Approximately over 80% of the communities in Dar Al Salam locality (figure 4) have described unavailability of livelihood resources related to financial and physical. Also 55% and 20% of the communities described unavailability of human resources and natural resources respectively. Based on these data it has become very obvious that there are large gaps between the importance and availability of the resources with exception of social resource which shown to be available to some extent in the three communities.

Kebkabiya locality (figure 5) is not an exceptional case. Approximately 60% of the communities have indicated that financial and physical resources are not available. And about 40% of the communities have described the natural resources and human resources as not available. In conclusion the analysis has stated a clear gap between the importance of the livelihood elements and their availability in the three localities.

**Summary and conclusion of the Livelihood status in the study area:**

**Financial Capital:** Financial saving, access to credit and remittances & and income levels over time are the main items affecting the financial situation of the communities. All communities have stated the importance of the financial saving and the remittances. Nevertheless; the availability of these items was described to be very scarce in most of the communities and completely not available in some of them.

**Physical Capital:** The lack of FC has directly affected the status of the PhC. The communities have stated the scarcity of agricultural implements for increasing the crop productivity, land size, household assets, and other infrastructures related to availability of water, electricity and access to roads.

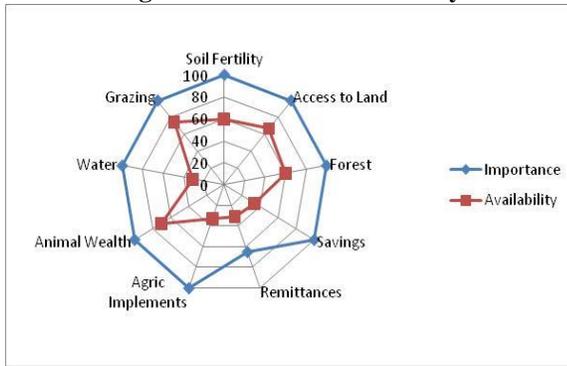
**Human Capital:** Educational and health levels were described as very important for the livelihood of the communities. But the quality of these services was described to be very low and also very expensive. At the same time due to rainfall shortage and failure of crop production the labour was described to be available but not fully utilized.

**Natural Capital:** Soil fertility, access to land, water availability, grazing sources, forest resources, ownership of herds, gum Arabic trees, and land productivity were described by the communities in the three communities as the main natural resources affecting the livelihood of the people. These resources with exception of soil fertility were described as either moderately not available or scarce. The scarcity of these elements could lead into competition between different communities and it has great potentiality to lead into friction between the communities and sometimes might lead into conflicts between the communities.

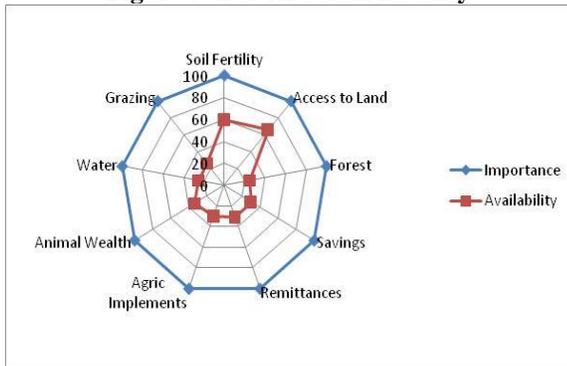
**Social Capital:** Adherence to rules, Relationship of trust, Mutuality of interest, Leadership (accountability of elected representations), Ethnic networks, and Social organizations (clubs, football team, professional unions) are questions were used to evaluate the status of social element. In this regard all communities have claimed the high availability of these elements. This is with exception of some communities in Kebkabiya locality. Apparently this is logic due to the conflict situation in the area. The appearance of high degree of social elements among the communities in the three localities; it gives the impression that the level of cooperation between the communities is promising to support the livelihood pillars.

**Deficiencies and Availabilities of Natural Resources elements in the study area:**

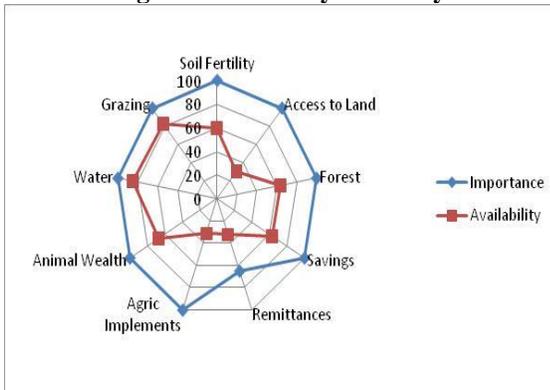
**Figure 6: Kalamendo Locality**



**Figure 7: Dar Al Salam Locality**



**Figure 8: Kebkabiya Locality**



Special care was devoted for the natural resources pillar which is the main area for this research. Specific issues related to the status of natural resources elements in the study area were discussed in more details below. The discussion was focused on the degree of importance and availability of access to land, forests, water, savings, agricultural implements, remittances, animal wealth, and soil fertility. In general there are huge gaps between the importance and the availability of most natural resources elements. But these gaps and availabilities were varying between locality to another. The upcoming details would give more explanations on this regard. These details are originated from the aforementioned figures (Figure 6, Figure 7, and Figure 8).

**Access to land:** Access to land was considered by significant number of communities as one of the important elements for the livelihood of the population. About 67% of the

communities in the locality of Kalamendo have described the access to land as secure but only 30% of the communities in Kebkabiya locality have described the access to land as secured, that means about 70% of the communities in Kebkabiya have challenges to access to land. The major reasons were mentioned as security concerns and not shortage of land.

**Access to Water:** Water was described by all communities as an important element. But only 31% and 25% of the communities in Kalamendo and Dar Al Salam respectively have described the availability of water in their respective areas. This indicates that approximately 75% of the communities in those localities are suffering to get water for human consumption and for watering their animals. The shortage of water was due to three reasons: the water sources are limited; inadequacy of water amounts in the available water sources, and the long distances to reach the water source itself. But 85% of communities in the locality of Kebkabiya have state the availability of water in their areas. It should be noted that all communities in Kebkabiya are getting water from the shallow wells along the valleys.

**Animal Holdings:** Approximately 70% of the population in Kalamendo and Kebkabiya own different animal species (no matter how many animals per household) and only 33% of the population in Dar Al Salam were claimed to own animals. The animal species were included cattle, sheep, goats, and camels in Kebkabiya. The populations who own small number of animals were normally keep them around the household yard and those who own large number of animals are normally keeping them away from the household peripheries.

**Access to Grazing:** About 75% and 83% of the communities in Kalamendo and Kebkabiya respectively have stated the availability of grazing in their areas; this is compared to only 26% of the communities in Dar Al Salam who confirmed the availability of grazing for the animals in their locality. That means about 74% of the population in Dar Al Salam are facing the shortages of grazing to their animals. The shortage of grazing and water in Dar Al Salam has led into complication of living situation to many people. To cope with such situation some of the populations have decided to migrate with their animals searching for water and grazing. Other groups of populations who were not able to migrate (probably due to limited number of their animals or due to other reasons) they have decided to collect the available grasses around their villages and even some of them have migrated to other villages for collection of grasses or hay. The collected grasses are kept for the dry season. Migrating to other areas for hay collection would cost the traveler to have strong donkey or more if available for carrying the grasses. The journey normally takes 1-2 days and so forth for 2-3 months after the rainy season. The purpose of this activity is to collect the grasses and give it to animals during the dry season when the grasses become Scarce in the area. This activity has stimulated many people to collect the grasses for trading purposes which has become source of income generating activities to many people. This probably types of trading mentioned by the communities in table-1.

**Savings & Remittances:** Financial savings is an important indicator about the capability of population to cope with the fluctuation of natural resources. Nevertheless; the populations in the three localities have shown low degree of capabilities to make savings or even no expectations of receiving remittances

from outside the area. Only about 30% of the population have the capability to make some savings or might receive remittances from other sources. Exceptionally in Kebkabiya locality about 63% of the population who are capable to make savings. This capability need to be noted as sign of capability of communities to make capital accumulations.

**Agricultural Implements:** the agricultural implements in this study was meant by the irrigation pumps, animal traction technology implements, tractors, pesticides sprayers, etc.. Use of technology is highly essential for increasing the productivity and the farmer income. Unfortunately only about 31% of the populations have confirmed to own some agricultural implements. This fact is linked with the inability of the populations to make savings or to acquire financial resources from any source such as lending institutions to help them obtain some technological inputs.

**Soil Fertility:** It seems that soil fertility is not a major problem in the study area. 60% of the populations have informed that their land is fertile, but the rainfall fluctuations are the major problems for the land productivity in the study area. People in the study area are using two types of lands; sandy soils and clay soils (along the valleys and the flooded areas). Most of the population using the clay soil they claim the high fertility of those lands. But rainfall fluctuations in many cases impede the utilization of those lands and low productivities of most crops. Water harvesting techniques are mechanisms capable to solve some of these problems. There were many local attempts to make interceptions along the valleys especially along the valley shared by the localities of Kalamendo and Dar Al Salam, but the incapacity of the populations are always behind the failures of such attempts. Any interventions related to such techniques would make positive outputs.

**Forest:** About 62% of the populations in the localities of Kalamendo and Kebkabiya have claimed the availability of forests in their areas. But only 25% of the populations in Dar Al Salam locality have claimed the availability of forests in their areas. That means about 75% of the population in Dar Al Salam locality have lost their forests over the past years. During the field survey it appeared that the majority of the populations are still using local material to build the houses, mass collection and transportation of firewood and charcoal to urban areas especially to Al Fasher. Even the description of forest availability is only meant by availability of some trees cover compared with other areas which are completely bare soils. Most of the populations did not confirm the availability of wildlife in their forests which means that the forests are of low density. Some populations are getting some wild food from their forests such as gum Arabic. However; those who claimed the availability of forests they confirmed that their forests are providing them with all local material for building of their houses.

#### Recommendations:

The study recommends the following

1. Provision of water
  - a) Increasing water capacity in Dar Al Salam locality
  - b) Management of existing water points in Kalamendo locality.
  - c) Construction of reservoirs for the herders in Kebkabiya locality and drilling of new water points in the grazing areas in

Kalamendo locality to reduce the pressure in the water points for human consumption.

2. Food security:
  - a) Provide protection for the IDPs to cultivate their farms in Kebkabiya locality
  - b) Protect the farms during the harvest time in Kebkabiya locality
  - c) Construction of small dams along the valleys in Dar Al Salam & Kalamendo localities for seasonal cultivation.
3. Environment:
  - a) Encourage the population in the localities of Kalamendo and Dar Al Salam to use environmental friendly material for buildings.
  - b) Increasing the capacity of the local civil society organization on issues related to environment conservation such as protection of the existing forests and initiation of communal forests. In this regard it is highly essential to provide the local organizations with enough training programs to help them play positive role on environmental issues. This is for the three localities.

4. Capital formation:

Most of populations (20%) in the locality of Kalamendo and Dar Al Salam have indicated that they have no ability to make savings. About (60%) of the population in Kebkabiya have the ability to make saving. Putting into considerations these facts; it has become quite clear that those populations are not in a position to increase their farming sizes or to improve the agricultural practices using their own resources. Hence, provision seeds of early maturity varieties and agricultural implements are of high value.

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# New Kernel Function in Gaussian Processes Model

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**Abstract-** New Kernel Design Technique was presented in the form of the sum of Linear Kernel, the multiplication of 3 Kernel Functions, including Squared Exponential Kernel, Linear Kernel and Rational Quadratic Kernel, and the multiplication of 2 Kernel Functions, including Periodic Kernel and Linear Kernel, which was used as a component for finding answers in the Gaussian processes. The results showed that the mean absolute percentage error predicted by the New Kernel Function, when the sample size was 180 (8.50E-15), was lower than the Squared Exponential Kernel (SE), Periodic Kernel (PER), Rational Quadratic Kernel (RQ) and Linear Kernel (LIN), which gave the Average Absolute Error of 2.57E-07, 5.56E-02, 2.63E-08 and 4.35E-01, respectively.

[**Keywords:** Kernel Function, Gaussian Processes, Composing Kernels ,Forecasting]

## 1. Introduction

There were several techniques used for the most accurate forecasting results. In general, the data used for forecasting was quantitative prediction technique data, which was a technique using historical data to create mathematical models used in forecasting. The techniques used could be divided into 2 broad categories as follows. First, Time series method, it was the way that only uses historical data to predict data in the future or our interested patterns of data or variable variation. There were several methods of forecasting. Each method had different analysis procedures. Examples of forecasting by time series method included Composite Forecasting Method, Moving Average Forecasting Method, Exponential Smoothing Forecasting Method, Autoregressive integrated moving average model (ARIMA) Forecasting Method, and Holt-Winter's Seasonal Exponential Smoothing Forecasting Method. Second, Causal Forecasting Method, it was the method that studies causal relationships and effects of interested variables with other variables influencing the interested variables. Examples of Casual Forecasting Method included Multiple Linear Regression Analysis, both linear and non-linear Neural Network Series.

Forecasting via Artificial intelligence, this forecasting technique had been developed rapidly and progressively as the system was capable of learning and thinking like humans, as an artificial intelligence model, data mining, or non-focused variable database. By the past several decades, there were more researches that were conducted by applying artificial intelligence techniques for forecasting. Examples of Artificial Intelligence Forecasting Method included Artificial neural network (ANN) [1,2], Fuzzy systems [3], Knowledge based expert system (KBES) [4], Wavelet analysis method [5], Support vector machine (SVM) method [6], and the new techniques currently accepted called Gaussian Processes.

Gaussian Processes was used in data mining, data classification, regression and time series data forecasting [7-10]. Gaussian processes [11-17] were now recognized as an effective tool for solving problems of regression, classification, and decision in machine learning. It worked effectively even with less training data, had better convergence rate than SARIMA, ANN, and supported Regression Vector Machine [9,18]. Gaussian processes was advantages over other Machine Learning techniques because of its full capabilities in forecasted probability distribution, as well as prediction of uncertainty of forecasting. These features made Gaussian processes an ideal tool for forecasting purposes [19].

The key element of Gaussian processes was the value of Kernel Function, or sometimes called the Covariance Function. The forecasting accuracy of the Gaussian processes' algorithm depended on the proper selection of Kernel Functions to match the problems. The Kernel Function had stationary properties, which remained constant over time [18]. Kernel Functions was a highly efficient method. It could work well with various types of data, such as string, vector, messages, etc. Also, it could find various ways of relationships, such as ranking, classification, cluster, etc. [18,20]. Many Kernel Functions were used in Gaussian processes for forecasting, for example, Radial Basis Function (RBF) or Exponential Quadratic Kernel, Rational Quadratic Kernel, Matérn Kernel, etc. [20].

Because of Kernel Function was the primary function in Gaussian processes, so the accuracy of forecasted data depended on the selection of Kernel Function and proper parameters adjustment [18,20,21]. Therefore, the problem was what Kernel Functions should be used. These problems needed to be tested and solved in order to obtain the accurate forecasting model. This research was aimed to create an effective new Kernel Function, compatible with many problematic conditions by mainly considering the time series data. Because the time series data of one variable might consist of only one, two, three, or all four types of data, so selecting one Kernel Function might not enough to deal with the problems of the prediction. Thus, the researchers combined Kernel Function models together as a new Kernel, which had Superposition properties [20] separating the variables that control the features of each functions freely.

## 2. Material and Method

**2.1 Gaussian processes** [22,23] was a random process or stochastic process, which could be defined as the distribution on the time function  $f(x)$  with the mean ( $m: x$ ), Covariance or known as Kernel Function  $k(x, x')$  or  $k(\tau)$  where  $\tau = x - x'$ , which could be generated from the time function  $f(x)$ , evaluating the match of the knowledge from Observation Set  $y = [y_1, y_2, y_3, \dots, y_N]^T$ , as a vector size where  $N \times 1$ , with Observation Set Input  $X = [x_1, x_2, x_3, \dots, x_N]^T$  with the same size of  $N \times 1$  [21]. This was defined as a Gaussian process [24]

$$y_i = f(x_i) + \varepsilon_i \tag{1}$$

$$f(x_i) \sim \mathcal{GP}(m(x_i), k(x_i, x_j)) \tag{2}$$

Where  $i$  was the index of measure, and  $\varepsilon \sim \mathcal{N}(0, \sigma_\varepsilon^2)$  was a Gaussian Distributed Error Model with Zero Mean and  $\sigma_\varepsilon^2$  variance.

The design model of observation was  $y_i = f(x_i) + \varepsilon_i$  according to Equation 1, where Covariance was equal to  $cov(y_i, y_j) = \mathbf{K}(x_i, x_j) + \sigma_\varepsilon^2 \delta_{ij}$ ;  $\delta_{ij}$  represented Kronecker Delta and  $\delta_{ij} = 1; i = j$ ; and others were equal to 0. The correlation between observation data and test target (Target:  $f_j$ ) was based on Equation 3.

$$\begin{bmatrix} y \\ f_j \end{bmatrix} \sim \mathcal{N} \left( 0, \begin{bmatrix} \mathbf{K}(X, X) + \sigma_\varepsilon^2 I_N & \mathbf{k}(X, x_j) \\ \mathbf{k}(X, x_j)^T & \mathbf{k}(x_j, x_j) \end{bmatrix} \right) \tag{3}$$

According to Equation 3, it was found that the conditional probability of  $P(f_j | x_i, \mathbf{y})$  was distributed on the function  $f(x_j)$  with the mean of  $m(x_j)$  and Covariance of  $cov(f_j)$  [25].

$$m(x_j) = \mathbf{k}(X, x_j)^T (\mathbf{K}(X, X) + \sigma_\varepsilon^2 I_N)^{-1} \mathbf{y} \tag{4}$$

$$cov(f_j) = \mathbf{k}(x_j, x_j) - \mathbf{k}(X, x_j)^T (\mathbf{K}(X, X) + \sigma_\varepsilon^2 I_N)^{-1} \mathbf{k}(X, x_j) \tag{5}$$

From the definition of the Gaussian process in (4), the Minimum Mean Square Error was used to forecast  $f(x_j)$  where:

$$f(x_j) \sim m(x_j) = E[f(x_j)|x_j, \mathbf{y}] \tag{6}$$

Therefore, it was possible to forecast the tested data by the mean of Gaussian processes, which was [26].

$$f(x_j) \sim m(x_j) = \mathbf{k}(X, x_j)^T (\mathbf{K}(X, X) + \sigma^2 I_N)^{-1} \mathbf{y} \tag{7}$$

The forecasted result was given by  $f(x_j) \sim m(x_j)$ . From the answer of Equation (7), the accuracy of the Gaussian processes' algorithm depended on the selection of appropriate functions for the Kernel Function. In addition, the relationship in Equation (7) could also be given in the form of a linear combination of  $n$  Kernel Functions [26].

$$f(x_j) = \sum_{i=1}^N \alpha_i \mathbf{k}(x_i, x_j) \tag{8}$$

$$\text{Where } \alpha = [\alpha_1, \alpha_2, \dots, \alpha_N]^T = (\mathbf{K}(X, X) + \sigma^2 I_N)^{-1} \mathbf{y}.$$

### 2.2 Kernel Functions

Kernel Function was a part of the Machine Learning algorithms that are closely related to Gaussian Processes [18].

Where  $\tau_{i-j} = x_i - x_j$ . Thus, the Cross Covariance of  $\mathbf{k}(X, x_j), \mathbf{K}(X, X)$  would be as follows:

$$\mathbf{K}(X, X) = \mathbf{K}(\tau) \sim \begin{bmatrix} k(\tau_0) & k(\tau_{-1}) & \dots & k(\tau_{-(N-1)}) \\ k(\tau_1) & k(\tau_0) & \dots & k(\tau_{-(N-2)}) \\ \vdots & \vdots & \ddots & \vdots \\ k(\tau_{(N-1)}) & k(\tau_{(N-2)}) & \dots & k(\tau_0) \end{bmatrix} \tag{9}$$

$$\begin{aligned} \mathbf{k}(X, x_j) &\sim [k(x_i, x_j) \dots k(x_N, x_j)]^T \\ &\sim [k(\tau_0) \dots k(\tau_{N-1})]^T \end{aligned} \tag{10}$$

The key element of Gaussian Process was the Kernel Function or sometimes called Covariance Function [20], where  $k(\tau_j)$  was set to Covariance data between the pairs of Functions  $f(x_i)$  and  $f(x_j)$  at the right position matching the input  $x_i$  and  $x_j$ , respectively, which was  $(\tau_{i-j}) = k(x_i, x_j) = cov(f(x_i), f(x_j))$ . Covariance Function would be selected to match the features of the function, which depended on the pattern of problems, whether time signal, flat signal, linear signal or polynomial signal. That is, there was no need to modify the form of the algorithm in Equation (7). When the function of interested problems changed, what to do is just adjust the Covariance Function or Kernel Function to suit the problem. Moreover, finding the distribution on the kernel's hyper-parameters could explain various properties of the data as well, such as rate of variation, periodicity, and smoothness [20]. In general, the Kernel Function was a pair-mapping of the inputs  $x_i \in X$  and  $x_j \in X$  into the  $\mathbb{R}$  domain and the covalence. Thus, for function  $f(x_i) \in \mathbb{R}$  with Zero Mean, the Kernel Function would be defined as [20].

$$k(\tau_{i-j}) = k(x_i, x_j) = cov(f(x_i), f(x_j)) = \mathbb{E}[f(x_i)f^*(x_j)] \tag{11}$$

Equation (11) was used as a Kernel Function of Gaussian processes according to Equation (5) and Equation (7), so any matrix  $\mathbf{K}(X, X) = \mathbf{K}(\tau)$  with elements in  $K_{ij} = k(x_i, x_j) = k(\tau_{i-j})$  must be a positive semi-definite matrix [21], with the condition stated that  $z^T K z \geq 0$  for all  $z \in \mathbb{R}^N$ .

### Squared exponential kernel

Squared exponential kernel known as radial basis function(RBF) or exponential quadratic kernel is a kernel that has been widely used with features as a function of time  $f(x)$  with the smoothness and slow change by  $\sigma$  and  $\ell$  is responsible for determining the size and amplitude sensitivity of the time changing [18] with a form of function being:

$$k_{SE}(x, x') = \sigma^2 \exp\left(-\frac{(x-x')^2}{2\ell^2}\right) \tag{12}$$

### Rational Quadratic Kernel

For exponential kernel with the sensitivity of the change of time function  $f(x)$  will depend on the scale value  $\alpha$  or  $\ell$ , the scope of time function  $f(x)$  created by rational quadratic kernel is an infinite sum of the squared exponential kernel with the  $\ell$  length that is different. The quadratic kernel was created to design complex data by the  $\alpha$  value of the rational quadratic kernel if  $\alpha \rightarrow \infty$ , it can be converted back into a squared exponential [18] with the form of the function is as below.

$$k_{RQ}(x, x') = \sigma^2 \left(\frac{(1+(x-x')^2/p)}{2\alpha\ell^2}\right)^{-\alpha} \tag{13}$$

### Periodic kernel

Kernel function designed for use with functions generated from Gaussian processes that appear to be redundant as proposed by MacKay in 1998 with the hyper parameters being  $\theta = \{p, \ell, \sigma\}$ .  $p$  is the length of the function signal in time.  $\ell$  and  $\sigma$  is the length of the repeating period and the size of the signal. If the hyper-parameter is correct, periodic signals from  $f(x_j)$  functions of the Gaussian processor may compare to find the hyper-parameter that can be generate of the Gaussian process or may be compared to find the hyper-parameter with the function being:

$$k_{PER}(x, x') = \sigma^2 \exp\left(\frac{2 \sin^2(\pi(x-x')/p)}{\ell^2}\right) \tag{14}$$

### Linear kernel

Linear functionality changed for a long-term from Gauss linear. The format of the function being:

$$k_{Lin}(x, x') = \sigma(x - \ell)(x' - \ell) \tag{15}$$

## 2.3 Composing Kernels

Kernel function in each category under the Gaussian process. Influence on different models of time function simulation. For this research, the researcher will newly create a kernel function based on time series data, which characteristics of the time series of a variable consists of four parts: a cycle, trend, a seasonal variation, and fluctuations from unusual events These 4 aspects are consistent with Each kernel function i.e. the trend looks consistent with the pattern of learning the long-term trends and the constant variance. It is a feature of the Linear X squared and linear kernel, cyclical character corresponds to the function model for Information sessions are repeated regularly, but not the type of time period kernel Seasonal variation is consistent with Patterns that are repetitive in time. It's corresponds to the time-type kernel function, which is a function for constant learning, even with variations and fluctuations from unusual events, and corresponds to Kernel quadratic, which is a function of complex change but also changes slowly and because the time series data of one variable may consist of one, two, three, or all four. One of the kernel functions may not cover the problem

of the forecast so taking the form of the kernel, the 4 functions are combined to be a new kernel with superposition [21] with the variable control features function independently in each category separately.

The research is focused on how to integrate the kernel function is Sum and Product.

$$k_a + k_b = k_a(x, x') + k_b(x, x') \tag{16}$$

$$k_a * k_b = k_a(x, x') * k_b(x, x') \tag{17}$$

Applying the form of Squared Exponential Kernel (SE), Periodic Kernel (PER), Rational Quadratic Kernel (RQ), and Linear Kernel (LIN) combined used in the simulation with Matlab program by using Monte Carlo technique.

The determination of the kernel function error to be used comparing the value of each kernel form by using:

Mean absolute deviation (MAD)

$$MAD = \frac{1}{t} \sum_{i=1}^t |e_i(1)| \tag{18}$$

Mean Square Error (MSE)

$$MSE = \frac{1}{t} \sum_{i=1}^t [e_i(1)]^2 \tag{19}$$

Mean absolute percentage error (MAPE)

$$MAPE = \frac{100}{t} \sum_{i=1}^t \left| \frac{e_i(1)}{Z_i} \right| \tag{20}$$

The kernel functions using low MAD, MSE or MAPE is better than the kernel functions using high MAD, MSE or MAPE.

### 3 Results and discussions

When combining the kernel function, Squared Exponential Kernel (SE), the Periodic Kernel (PER), Rational Quadratic Kernel (RQ), and Linear Kernel (LIN) together by applying the Sum and Product structures, the new forms of Kernel function totally 3,639 profiles derived, as shown in Table 3.1.

Table 3.1 shows the new kernel function model.

Rank	Kernel function mode	Number of mode
1	(SE*PER)+(SE*RQ)+(SE*LIN)	20
2	(SE*PER*RQ*LIN)+SE	4
3	(SE*PER*RQ*LIN)+SE+PER	6
4	(SE*PER*RQ*LIN)+SE+PER+RQ	4
5	(SE*PER*RQ*LIN)+SE+PER+RQ+LIN	1
6	(SE*PER)+(SE*RQ)+(SE*LIN)+SE	80
7	(SE*PER)+(SE*RQ)+(SE*LIN)+SE+PER	120
8	(SE*PER)+(SE*RQ)+(SE*LIN)+SE+PER+RQ	80
9	(SE*PER)+(SE*RQ)+(SE*LIN)+SE+PER+RQ+LIN	20
10	(SE*PER*RQ)	4
11	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ)	80
12	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ)+SE	320
13	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ)+SE+PER	480
14	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ)+SE+PER+RQ	320

Rank	Kernel function mode	Number of mode
15	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ)+SE+PER+RQ+LIN	80
16	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ*LIN)	20
17	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ*LIN)+SE	80
18	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ*LIN)+SE+PER	120
19	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ*LIN)+SE+PER+RQ	80
20	(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*RQ*LIN)+SE+PER+RQ+LIN	20
21	(SE*PER*RQ)+(SE*PER)	24
22	(SE*PER*RQ)+(SE*PER)+SE	96
23	(SE*PER*RQ)+(SE*PER)+SE+PER	144
24	(SE*PER*RQ)+(SE*PER)+SE+PER+RQ	96
25	(SE*PER*RQ)+(SE*PER)+SE+PER+RQ+LIN	24
26	(SE*PER*RQ)+(SE*PER)+(SE*PER)	60
27	(SE*PER*RQ)+(SE*PER)+(SE*PER)+SE	240
28	(SE*PER*RQ)+(SE*PER)+(SE*PER)+SE+PER	360
29	(SE*PER*RQ)+(SE*PER)+(SE*PER)+SE+PER+RQ	240
30	(SE*PER*RQ)+(SE*PER)+(SE*PER)+SE+PER+RQ+LIN	60
31	(SE*PER*RQ*LIN)+(SE*PER)	6
32	(SE*PER*RQ*LIN)+(SE*PER)+(SE*PER)	15
33	(SE*PER*RQ*LIN)+(SE*PER)+(SE*PER)+(SE*PER)	20
34	(SE*PER*RQ*LIN)+(SE*PER)+SE	24
35	(SE*PER*RQ*LIN)+(SE*PER)+SE+PER	36
36	(SE*PER*RQ*LIN)+(SE*PER)+SE+PER+RQ	24
37	(SE*PER*RQ*LIN)+(SE*PER)+SE+PER+RQ+LIN	6
38	(SE*PER*RQ*LIN)+(SE*PER)+(SE*PER)+SE	60
39	(SE*PER*RQ*LIN)+(SE*PER)+(SE*PER)+SE+PER	90
40	(SE*PER*RQ*LIN)+(SE*PER)+(SE*PER)+SE+PER+RQ	60
41	(SE*PER*RQ*LIN)+(SE*PER)+(SE*PER)+SE+PER+RQ+LIN	15
	Total	3639

The error of each kernel function was calculated by simulating with Matlab. The errors are shown in Table 3.2.

Table 3.2 shows the error of each kernel function.

kernel function	Error
(SE*PER)+(SE*RQ)+(SE*LIN)	MSE = 5.0606e-08 , MAPE = 1.5773e-08 , MAD = 0.00016173
(SE*RQ)+(SE*LIN)+(PER*RQ)	MSE = 8.9383e-08 , MAPE = 1.9872e-08 , MAD = 0.00023003
(SE*LIN)+(PER*RQ)+(RQ*LIN)	MSE = 1.1278e-07 , MAPE = 2.2979e-08 , MAD = 0.00026739
⋮	⋮
(SE*PER)+(SE*RQ)+(SE*LIN)+(SE*PER*LIN)+PER+RQ	MSE = 7.3625e-07 , MAPE = 2.095e-08 , MAD = 0.00029638
(SE*RQ)+(SE*LIN)+(PER*RQ)+(SE*PER*LIN)+PER+RQ	MSE = 1.077e-07 , MAPE = 2.0197e-08 , MAD = 0.00021762
(SE*LIN)+(PER*RQ)+(RQ*LIN)+(SE*PER*LIN)+PER+RQ	MSE = 1.3068e-06 , MAPE = 3.1908e-08 , MAD = 0.00045056
⋮	⋮
(SE*PER*LIN)+(RQ*LIN)+LIN	MSE = 1.2045e-06 , MAPE = 3.1356e-08 , MAD = 0.00044047
<b>(SE*RQ*LIN)+(LIN*PER)+LIN</b>	<b>MSE = 2.7497e-12 , MAPE = 1.1273e-11 , MAD = 2.9533e-07</b>
(SE*RQ*LIN)+(RQ*LIN)+LIN	MSE = 3.9171e-07 , MAPE = 9.5851e-09 , MAD = 0.00014228
⋮	⋮
(SE*PER*RQ*LIN)+(SE*LIN)+(PER*RQ)+SE+PER+RQ+LIN	MSE = 1.2207e-07 , MAPE = 2.4202e-08 , MAD = 0.0002773
(SE*PER*RQ*LIN)+(SE*LIN)+(PER*LIN)+SE+PER+RQ+LIN	MSE = 1.2234e-06 , MAPE = 2.9656e-08 , MAD = 0.00042943
(SE*PER*RQ*LIN)+(PER*LIN)+(RQ*LIN)+SE+PER+RQ+LIN	MSE = 1.1191e-06 , MAPE = 2.4754e-08 , MAD = 0.00036224

The results showed that the most efficient new kernel function was as follows;

$$k_{(SE*RQ*LIN)+(LIN*PER)+LIN}$$

The form of the new kernel function derived according to the equation (21).

$$k(x, x') = \left( \sigma^2 \exp\left(-\frac{(x-x')^2}{2\ell^2}\right) \left(\frac{(1 + \frac{(x-x')^2}{p}}{2\alpha\ell^2})^{-\alpha}\right) (x-\ell)(x'-\ell) \right) + \left( \sigma^2 \exp\left(\frac{2 \sin^2(\frac{\pi(x-x')}{p})}{\ell^2}\right) (x-\ell)(x'-\ell) \right) + (\sigma(x-\ell)(x'-\ell)) \tag{21}$$

When comparing the performance among the new kernel functions, Squared Exponential Kernel, Periodic Kernel, Rational Quadratic kernel, and Linear kernel, when the sample size were different, the results were show in Table 3.3.

Table 3.3 shows the performance comparison among the new kernel functions, Squared Exponential Kernel, Periodic Kernel. Rational Quadratic kernel, and Linear kernel, when the sample size are 36, 60, and 180 .

KERNEL	MSE			MAPE			MAD		
	N=36	N=60	N=180	N=36	N=60	N=180	N=36	N=60	N=180
<b>New</b>	1.94E-19	7.41E-13	6.70E-11	8.50E-15	1.23E-11	6.62E-11	1.79E-10	2.90E-07	1.43E-06
<b>SE</b>	1.46E-05	2.97E-06	4.09E+04	2.57E-07	1.19E-07	1.31E-02	2.17E-04	9.96E-05	1.60E+02
<b>PER</b>	9.52E+05	9.51E+05	7.81E+05	5.56E-02	5.58E-02	6.11E-02	8.06E+02	7.99E+02	7.26E+02
<b>RQ</b>	2.54E-07	4.86E-08	3.03E-07	2.63E-08	1.20E-08	3.44E-08	3.86E-04	1.72E-04	4.20E-04
<b>LIN</b>	5.96E+07	5.87E+07	6.09E+07	4.35E-01	4.23E-01	5.09E-01	5.84E+03	5.77E+07	5.84E+03

The results of the performance comparison among the new kernel functions, Squared Exponential Kernel, Periodic Kernel, Rational Quadratic Kernel, and Linear Kernel are shown in Figure 3.1.

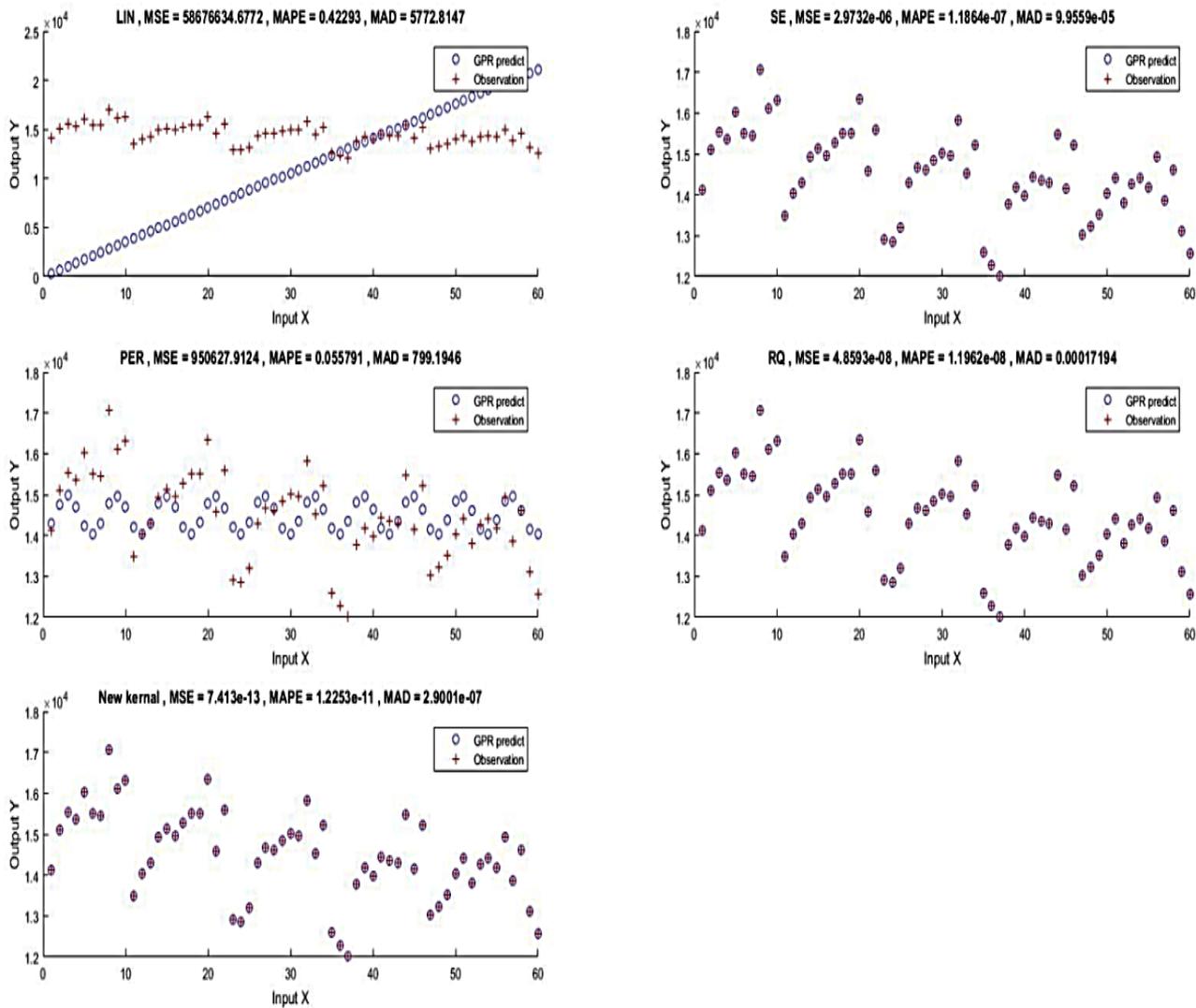


Figure 3.1 shows the performance comparison among the new kernel function, Squared Exponential kernel, Periodic kernel, Rational Quadratic kernel, and Linear kernel when the sample size is 60

## Discussions

In this paper, we have presented a brief outline of the conceptual and mathematical basis of GP modelling of time series. We found that the structures are often capable of accurate extrapolation in complex time-series datasets, and used kernel combination methods on a variety of prediction tasks. The goal of automating the choice of kernel function, we introduced a space of composite kernels defined compositionally as sums and products. The learned kernels often yield decompositions of a signal into diverse and interpretable components. We believe that a data-driven approach to used new kernel structures can help make forecasting and classification methods accessible to non-experts.

## 4 Conclusions

The current forecast that is needed to find out about the future has been highly focus because forecast plays an extremely important role in the plot and decision making about the operation of every individual profession and various organizations. The forecasted value will be used to plan and make decision. In the past,

there have been researches conducted on the forecast with the techniques used were ARMA, SVR, artificial neural networks, and Gaussian processes.

This study presents a method to predict the Gaussian kernel to forecast by designing new functions in line with the characteristics of time series data by blending squared exponential kernel periodic, rational, quadratic, and linear technique in which the application presentation of the kernel function to fit a long-term trend. It is the hyper parameters of 16 kernel functions, which is multiplied by the squared exponential kernel is the introduction of long-term relationships of the model or change the relationship slowly and multiplied with a linear kernel. This is equivalent to the multiplication of functions that have been modeled by linear functions resulting in standard deviations without affecting the relationship functional value. When multiplied by the kernel function quadratic, it would likely cause a change in the long run complex has a smooth slow contained hyper- 8 parameters:  $\theta_1$  Actively controls the amplitude of the data  $\theta_2$ , the sensitivity of the information. It also serves to weight the variance of the data  $\theta_3\theta_4$ , and  $\theta_6$  generated by the change.  $\theta_5$  adjusts the frequency of each period.  $\theta_7$  controls the size of the difference of information and  $\theta_8$  controls the variance of the data. The result of multiplication of the three kernels cause a change in the trend of complex changes in the long run, repeated pattern. It also contains discrepancies in information including seasonality. To be effective for volatile data generated by other external variables, multiplication was conducted with a linear kernel by  $\theta_9$  is responsible for determining sensitivity. Change of information to correspond to  $\theta_{10}$  with the duty to adjust the frequency in the repetition period and  $\theta_{11}$  is responsible for determining the data period. This will make the output repeatable and varied with  $\theta_{12}$  and  $\theta_{13}$  being responsible for controlling the size of the difference of data, determining the size of the linear kernel data multiplication time-type kernel function resulted in less variance with a wider range of amplitude and information in the form of long-term linear trend with a positive linear kernel making the trend in the long run smooth with more constant variability containing hyper-parameters being  $\theta_{14}$  to control the amplitude of the  $\theta_{15}$  and  $\theta_{16}$  data to control the difference of information to a constant variance.

From the test results, it was found that this new kernel function using 16 hyper-parameters had the ability to forecast the precision and efficiency, and water when making comparisons to the kernel, the squared exponential kernel Periodic kernel and rational quadratic and linear kernel yielded more effective precision.

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# Service Quality and Student Satisfaction in Higher Education Institutions: A Review of Literature.

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**ABSTRACT-** This is a conceptual paper that examines service quality and student satisfaction in higher learning institutions. It presents the reviews of the literature on the service quality construct in higher education and its influence on student satisfaction. The theoretical perspective of this paper included the Gap Model of service quality and the hierarchical service quality model. The various instruments for measuring service quality in higher education have been discussed briefly with a summary of the measurement instruments by different authors and their dimensions provided. The empirical studies have indicated that there is no consensus among authors on the dimensions that should be used to evaluate service quality in the higher education sector and hence different dimensions and measurement scales have been used by different authors. This paper concludes that service quality in higher education has a significant influence on student satisfaction and therefore higher education institutions should put in place mechanisms to collect student feedback to enable them to determine the service quality dimensions of interest to their students so that they can make the necessary improvements on the relevant service quality dimensions.

**Index Terms-** Service Quality, Student satisfaction, Servqual, Hedperf, and ServPerf.

## I. INTRODUCTION

In recent years massive changes in policy, structure and status of higher education institutions have taken place all over the world. Issues such as privatization and increased competition among higher learning institutions are now common in most countries. Hill (1995), states that higher education is a service industry and that service quality is a critical determinant of the success of higher learning institutions (Landrum, Prybutok & Zhang, 2007).

In order to succeed in today's competitive higher education sector, service quality is of essence to any institution of higher learning (Sandhu & Bala, 2011). In view of this, higher education institutions must assess the quality of their services since outstanding service quality can provide them with competitive advantage (Albretch, 1991). If the higher education institutions provide quality service which meet or exceed that expectations of their students, their services will be evaluated as high quality service and if not, the services will be judged as poor (Zammito *et al*, 1996)

Student satisfaction is a major challenge for higher education institutions and as Arambewela and Hall (2009) posit, it is also

the major source of competitive advantage and the student satisfaction leads to student attraction, retention and the spread of positive word of mouth communication by satisfied students. Abdullah (2006) states that higher education institutions have to incorporate student satisfaction as an important component of their management in addition to their core business of teaching and research. Therefore, students are not seen as participants in the process of higher education but as customers or consumers of the process.

## Service Quality

The definition of service quality can be provided from the perspective of how the consumers or users of the service judge the service based on what they may have experienced. The service quality construct in the services literature is based on perceived quality. Zeithaml (1987) and Zammuto *et al* (1996) define perceived quality as the consumer's judgement about an entity's overall experience or superiority. Perceived quality is also seen as a form of attitude related to, but not the same as satisfaction and it results from a comparison of expectations with perception of performance (Rowley, 1996).

According to Parasuraman, Zeithaml and Berry (1990), consumer perceptions of service quality results from comparing expectations prior to receiving the service and the actual experience of the service. In higher education institutions, perceived service quality can be the product of evaluating a number of service encounters for a student and these could range from encounters with administrative staff, to encounters with lecturers, librarian and security staff. If an institution consistency provides services at a level that exceeds customer expectations, the services will be evaluated as high quality but if the services fail to meet customer expectations, the services will be judged as poor quality (Zammuto *et al*, 1996).

In the higher education sector, service quality is considered as a key determinant of the performance of higher education institutions and in view of this, Zeithaml *et al* (1990) propose that service quality be defined as the conformance to student specifications. The implications of this is that it is the students of an institution of higher learning who define quality. The students determine the perceived or cognitive value of services based on their previous experience with the service delivered and therefore student expectations, service delivery process and the service output of higher education institutions have an impact on perceived service quality. Oldfield and Baron (2000) argue that students have three main criteria that need to be satisfied by higher education institution and there are identified as requisite encounter which enable students to fulfill their study obligations,

acceptable encounters which students acknowledge as being desirable but not essential during their studies and functional encounter which are of a practical or utilitarian nature.

In examining the determinants of quality in a service, it is necessary to distinguish between quality associated with the process of service delivery and the quality associated with the outcome of the service which is judged by the consumer after the service is performed (Gronroos, 1984). Parasuraman, Zeithaml and Berry (1985) identified ten determinants of service quality that could be generalized to any type of service. The ten determinants are tangibles, reliability, responsiveness, competence, access, courtesy, credibility, security, communication and understanding. These ten determinants are tangibles, reliability, responsiveness, competence, access, courtesy, credibility, security, communication and understanding. These ten determinants were re-grouped by Parasuraman et al (1990) to form the well-known five dimensions of the SERVQUAL model and they are Tangibility, Assurance, Empathy, Reliability and Responsiveness.

Earlier studies on service quality in the higher education sector have often emphasized academic factors more than administrative factors, concentrating on effective course delivery mechanisms and the quality of courses and teaching (Athiyaman, 1997; Cheng & Tam, 1997; Soutar and McNeil, 1996). However Kamal and Ramzi (2002) looked at the administrative side of higher education by measuring student perception of registration and academic / career advice across different facilities and other administrative services to assure positive quality of courses and teaching (Athiyaman, 1997; Cheng & Tam, 1997; Soutar and McNeil, 1996). However Kamal and Ramzi (2002) looked at the administrative side of higher education by measuring student perception of registration and academic / career advice across different faculties and other administrative services to assure positive quality service that compliments the academic services.

### Service Quality Dimensions.

The main concern with the dimensions of service quality is usually the range of areas which should be included. Cronin and Taylor (1994) state that customers should be the determinants of service quality dimensions rather than the management or the academic staff of the respective institution of higher education. Parasuraman et al (1990) proposed five dimensions of service quality as follows;

1. Tangibles: the equipment, physical facilities and appearance of personnel.
2. Empathy: The provision of caring and individualized attention to customers.
3. Reliability: The ability to perform the desired service dependably, accurately and consistently.
4. Responsiveness: The willingness to provide prompt service and help customers.
5. Assurance: Employees courtesy, knowledge and ability to convey trust and confidence.

Gronroos (1988) also identified six criteria of good perceived service quality including;

Attitudes and behaviour: customer perceive a genuine, friendly concern for them and their problems.

Reliability and trustworthiness: customer can trust the service provider to keep promises and act in their best interests.

Access and flexibility: customer feel that they have easy, timely access and that the service provider is prepared to adjust to their needs.

Professionalism and skills: customers see the service provider as knowledge and able to solve their problems in a professional way.

Recovery: customers know that immediate corrective action will be taken if anything goes wrong.

Reputation and credibility: customers believe that the brand image stands for good performance and accepted values.

Gronroos (1990) further states that service quality dimensions can be grouped into three categories; technical quality (service product), functional quality (service delivery) and corporate image (service environment). The technical quality dimensions can be measured objectively regardless of customer's opinion while functional quality issues are related to the interaction between the service provider and recipient of the service are usually measured in a subjective manner.

In the higher education sector, Carney (1994) proposed nineteen variables that can be used to evaluate the image of a college. These variables include variety of courses, academic reputation, class size, student qualification (academic), student qualities (personal), faculty – student interaction, quality instruction (faculty), career preparation, athletic programs, student activities (social life), community service, location, physical appearance (campus), on – campus residence, facilities and equipment, friendly, caring atmosphere, religious atmosphere, safe campus and cost (financial aid, Arivalan et al posit that though the nineteen variables were developed to evaluate college image, they are also highly relevant to the measurement of service quality.

Similarity, Athiyaman (1997) identified eight variables that can be used to evaluate university education services and they include library services, availability of staff for student consultation, teaching students well, computing facilities, recreational facilities, class sizes, level and difficulty of subject content and student workload.

Owlia and Aspinwall (1996) conducted a thorough literature review on service quality and grouped the service quality attributes into six dimensions as follows:-

Tangibles: the institution having sufficient equipment / facilities, modern equipment / facilities, ease of access to the facilities, visually appealing environment and support services such as accommodation / hostels.

Competence: the institution having sufficient academic staff who have theoretical knowledge, qualifications, practical knowledge and upto date teaching expertise and communication skills.

Attitude: The institutions staffs understands students' needs, are willing to help, are available for guidance and advisory, give personal attention to students and are courteous and friendly.

Content: the relevance of curriculum to the future jobs of students, curriculum containing primary knowledge, skills as well as flexibility of knowledge.

Delivery: effective presentation, sequencing, timeliness, consistency, fairness of examinations, feedback from students.

Reliability: trustworthiness, offering recognized courses, keeping promises, handling complaints and timely resolution of problems.

After further analysis of the six variables, Owlia and Aspinwall (1996) later recommended that academic resources, competence, attitude and content be used as a framework for service quality measurement in higher education.

### **Student Satisfaction**

Conceptualization of the satisfaction construct can be distinguished in terms of the specific transaction or the specific brand (Anderson et al, 1994). Oliver (1980) argues that transaction – brand specific limits satisfaction to a specific occasion but the cumulative customer satisfaction refers to the overall evaluation based on a number of purchase and consumption experiences of a service over time. Anderson et al (1994) states that customer satisfaction can be viewed as a function all the previous transactions and specific transactions. According to Hom (2002), researchers are facing a challenge in creating a standard definition for the concept of student satisfaction and therefore there is a need for a customer satisfaction theory to be selected and modified so that it can explain the meaning of student satisfaction. Satisfaction can be defined as a state felt by a person who has experienced performance or an outcome that fulfill his or her expectations and it perceives performance (Kotler & Clarice, 1987). Satisfaction is also defined by Malik, Danish and Usman (2010) as the intentional performance that results in one's contentment.

The concept of satisfaction in the context of higher education focuses on the student community. Oliver and Desarbo (1989) define student satisfaction as the favorability of a student's subjective assessment of the numerous outcomes and experiences related with education and being shaped continually and repeated experiences in campus life. Student satisfaction is also the short term attitude that results from the evaluation of their experience with the education service received. Institutions of Higher Education tend to be concerned with student satisfaction due to its impact on student motivation, recruitment of new students and retention of existing students.

Students are the key customers of higher education institutions and Illias et al (2008) state that student satisfaction is built continuously with experiences on campus during their study period. Student satisfaction is crucial since satisfied students could end up going back to their previous institutions for further studies or to enroll for new courses (Helgesen & Nasset, 2007). In view of this, higher education institutions should make every effort towards meeting and exceeding the expectations of their students in order to ensure the sustainability of their operations (Anderson et al, 1994).

Higher education institutions can use student feedback to evaluate the level of student satisfaction with the services provided Rowley (2003) outlined four reasons why collecting student feedback is important to such institutions and they are;

To provide students with an opportunity to express their level of satisfaction with their academic experiences at the institution.

To provide auditable evidence that students have had the opportunity to commend on their experiences and that such information is used to make improvements.

To allow the institutions to benchmark and provide indicators that will contribute to the reputation of the institution in the market place.

To encourage students to reflect on their experiences at the institution as they learn.

Students in higher education institutions rate their tutors' performance and methodology of teaching as the prime indicators in their educational development and successful completion of their studies. Malin et al (2010) argued that the tutors abilities excellence, coordination and flexibility greatly influence the student's academic performance. Sherlin et al (2000) also stated that tutors who are punctual and friendly to students are more popular. In view of this, Banwet and Dalta (2003) have pointed out that services are delivered to people by people and that moment of truth can make or break an institutions image.

The implication is that to achieve student satisfaction higher education institutions must focus on every aspect of the students experience at the institutions must focus on every aspect of the students' experience at the institution (Devinder & Dalta, 2003). According to Anantha et al (2012), student satisfaction is not limited to the lectures in class or guidance by tutors during the consultation hours but it includes the students' experiences while interacting with the non – academic staff, the physical infrastructure and other non – academic aspects of college life such as participation in sporting activities such as football.

### **Service Quality and Student Satisfaction in Higher Education Institutions**

In the higher education context, the student is considered to be a key customer. The first author to introduce the concept of students as customers in higher education was Crawford (1991) and therefore student satisfaction is viewed as a good indicator of the quality of teaching at the institutions of higher learning and is also an outcome measure of the education process (Ramsden, 1991). However measuring students satisfaction is not an easy task and authors differ on which indicators should be used to measure student satisfaction 9Athiyaman, 1997; Elliot & Shin, 2002).

There exists the question as to whether customer's satisfaction is an antecedent to service quality or whether it is service quality that leads to customer satisfaction. Parasuraman et al 1998; Bitner (1990) and Bolton and Drew (1991) are of the view that customer satisfaction is an antecedent of service quality while woodside et al (1989), Spreng and Mackoy (1996) and Hoisington and Naumann (2003) are of the view that service quality leads to customer satisfaction. Researchers such as Cronin and Taylor (1992); Dion et al, (1998) and Lee et al (2000) have provided empirical evidence which supports the view that service quality is a precursor to customer satisfaction as cited by Ashish and Faizaan (2016).

## **II. LITERATURE REVIEW**

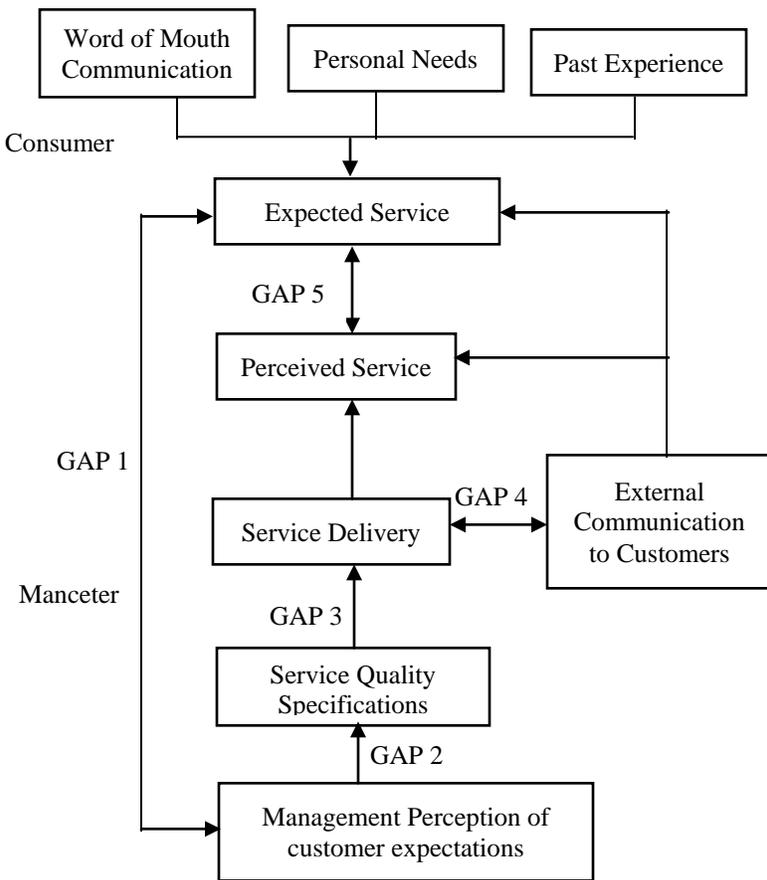
### **Theoretical perspectives**

#### **The GAPS Model of Service Quality**

The GAPS Model of Service quality was first developed by Parasuraman, Zeithaml and Berry (1985) and it has served as a

framework for research in services marketing for over two decades. The Model is based on the expectation- confirmation theory (Oliver, 1980; 1993) and it illustrates how customers assess quality, taking into account quality offered by firms and the quality perceived by users after the service consumption. The GAPS model aims to identify the possible causes for a gap between expected quality and perceived quality. The model conceptualizes key concepts, strategies and decisions which are essential for the quality offer according to a sequence which starts from the consumer, identifies the necessary actions for the firm to plan and offer a service and goes back to the consumer for the comparison between expectations and perceptions.

Figure 2.1 illustrates the GAPS Model.



Source: Parasuraman, Zeithaml and Berry (1985)

The GAPS model in figure 2.1 outlines five service quality gaps which are.

**GAP 1:** -It is first gap in service quality and it occurs when the management of a firm fails to accurately identify customer expectations. It is also referred to as the knowledge gap.

**GAP 2:-** It is known as the design gap and it is measured to the management’s perception of customer expectations. This gap depends on the management’s belief that quality is important as well as the resources available for the provision of that service.

**GAP 3:-** It represents the variation in service design and services delivery. It is referred to as the performance gap. Since individuals perform the service, performance will depend on the

skill level or the level of training of the individual providing the service.

**GAP 4:-** It is known as the communications gap since it is the difference between what is promised to customer explicitly or implicitly and what is actually being delivered. Over – promising is usually responsible for this gap.

**GAP 5:**It is the total accommodation of variations in gaps to it and it represents the difference between the customer expectations and the perceived service.

According to Parasuraman et al (1985) consumers evaluate perceived service along five quality dimensions namely:

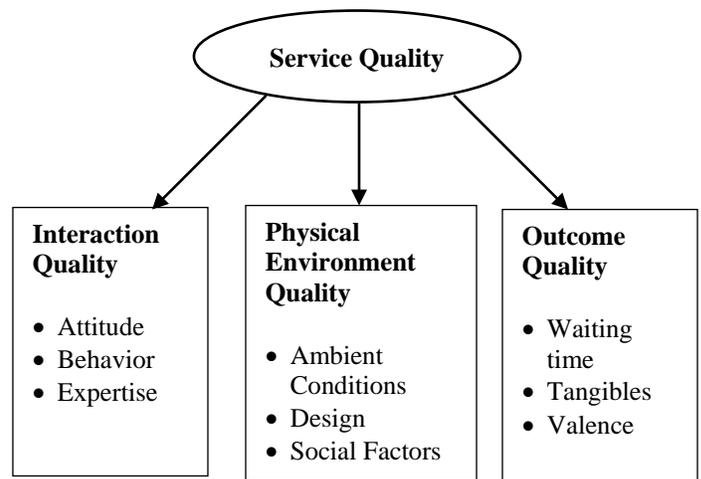
1. Reliability – The ability to perform the promised service dependably and accurately
2. Responsiveness - The willingness to help customers and to provide prompt service.
3. Assurance - The employee knowledge and courtesy and the ability of the firm and its employees to inspire trust and confidence in its customers.
4. Empathy - The caring, individualized attention the firm provides to its customers.
5. Tangibles – The appearance of physical facilities, equipment, personnel and communication materials.

Each time they experience a service, consumers evaluate the service quality by judging the experience based on the fine dimensions. (Parasuraman et al, 1985).

### The Hierarchical Service quality Model.

The Hierarchical service quality model was proposed by Brady and Cronin (2001) and it is a comprehensive, multi-level construct that consists of three primary elements known as interaction quality, physical environment quality and outcome quality.

Figure 2.2 illustrates the Hierarchical service quality model.



Source: Adapted from Brady and Cronin (2001)

According to Brady and Cronin (2001), Interaction quality deals with the experience that customers have with employees who provide the services and it is one of the factors that influence customer satisfaction. Altitude, Behaviors and expertise of the employee are sub- dimensions of the interaction quality.

Physical environment quality includes the physical and social setting in which the institution operates such as buildings, cleanliness and availability of customer's personal space. Ambient conditions, design and social factors as the sub-dimensions of the physical environment quality, Walter et al (2010) argues that the physical environment is crucial to customers because service delivery occurs in the physical environment where the design, production and delivery of the services are of value to customers. The interior and exterior of the physical environment can also create positive or negative experiences to customer (Walter et al; 2010).

Outcome quality refers to the outcome of the services performance and represents what the consumer achieves from the service. The sub dimensions that contribute to outcome quality are waiting time, tangibles and valence which contribute to customer satisfaction. Hensley and Sulek (2010) argue that customers become dissatisfied with a service if they have to wait for a long time to be served. Many service firms also worry about customer queues as it may elicit negative perceptions on the quality of customer service (Bielen & Demoulin, 2007). Valence is the post consumption of the overall outcome regardless of evaluation of specific aspects of service quality. Customers form service quality perceptions by evaluating services performance at multiple lends and ultimately combine these evaluations to arrive at an overall service quality perception (Brady & Cronin, 2001).

**Instruments for measuring service quality in Higher education**

The term service quality has a significant richness and delivery of meaning. As such, progress in designing and developing a generic framework for measuring service quality has been hampered by the inherent problems commonly associated with the unique characteristics of services namely intangibility, perish ability, inseparability and heterogeneity (Zeithaml et al ; 1985). Similarly Carman (1990) and Bolton and Drew 91991) Concur that service quality is an elusive concept and there is considerable debate in the services literature about how best to measure it.

The SERVQUAL Instrument of Parasuraman et al. (1985) has attracted the greatest attention claiming to measure the relevant dimensions of the perceived quality across service industries based on fire dimensions namely; reliability, responsiveness, empathy, assurance and tangibles. Despite its popularity, Cronin and Taylor (1992) criticized the SERVQUAL instrument by arguing that there is little evidence either theoretically or empirically to support the notion of 'expectations minus performance' gap as a basis for measuring service quality. They proposed a 'performance only' measure of service quality known as SERVPERF. In their empirical work, Cronin and Taylor (1992) argued that the SERVPERF instrument performs better than any other measure of service quality.

In higher education, service quality measurement has intensified with increased emphasis on education accountability. Ho and Wearn (1996) incorporated the SERVQUAL into HETQMEX, A Higher Education TQM excellence model that measured service quality based on areas such as leadership, commitment, training education and teamwork. More recently, the Higher Education performance scale (HEdPERF) was developed by Firdaus (2006) and the instrument aimed at considering not only the academic

components of service quality but also the total service environment. Table 2.1 provides a summary of the various authors and measurement scales developed for measuring service quality and the dimensions covered by each scale.

**Table 2.1: Selected Service quality studies and dimensions in higher education.**

Author (s)	Service Quality Dimensions
Zeithaml et al (1990) Parasuraman and Berry (1991) Service Quality Model (SERVQUAL)	Tangibles Reliability Responsiveness Assurance Empathy
Cronin and Taylor (1992) Performance only; service Quality Performance Model (SERVPERF)	Reliability Assurance Tangibles Empathy Responsiveness
Owlia and Aspinwall (1996)	Tangibles Competence Attitude Content Delivery Reliability
Ho and Wearn (1996) Higher Education TQM model of excellent (HETQMEX)	Leadership Commitment Total customer satisfaction Total involvement Training education Ownership of problem Reward and recognition Error prevention Teamwork
Athiyaman (1997)	Teaching students well Availability of staff for student consultation Library services. Computing facilities Recreational facilities Class size Level and difficulty of subject content Student workload
Sangeeta et al (2004)	Competence Attitude Content Delivery Reliability
Firdaus (2006) Higher Education Performance (HedPERF)	Non – Academic aspects. Academic aspects Reputation Access Programme issues Understanding.
Pereda et al (2007)	Sufficient resources Quality of faculty Tangibility

	Reliability
Sultan and Wong (2010) Performance Based Higher education service Quality Model (PHed)	Dependability Effectiveness Capability Efficiency Competencies Assurance Unusual situation management Semester and syllabus
Annamderula and Bellamkonda (2012) Higher Education Service Quality (HiEdQUAL)	Teaching and course content Administrative services Academic facilities Campus infrastructure Support services

Source: Adapted from Prasad and Jha (2013)

Different dimensions of service quality have been used by different researchers. According to Cronin and Taylor (1994) and Lee et al (2000), customers must be the determinant of service quality dimensions rather than the management of an institution. Hadikoemoro (2002) argues that developing a service quality model to measure the student's perception of service quality dimensions cover many aspects and therefore it is put possible to cover all aspects.

### III. EMPIRICAL REVIEW

#### Empirical studies

Hassan et al (2008) studied service quality and student satisfaction in Malaysia using a case study of private higher education institutions. The findings indicated that the SERVQUAL dimensions of tangibility, responsiveness, assurance, reliability and empathy had a significant positive relationship with student satisfaction.

Malik et al (2010) investigated the impact of service quality on student's satisfaction in higher education institutes of Punjab province in Pakistan. They used the SERVQUAL instrument and their findings showed that students were satisfied with the tangibles, assurance, reliability and empathy but not with parking facilities, computer labs, cafeteria service and the complaint handling system. Asaduzzaman et al (2013) also examined service quality and student satisfaction in private universities in Bangladesh using a sample of 550 business students. They study used the SERVQUAL dimensions and the findings indicated a significant correlation among all the dimensions with student satisfaction.

Similarly Sultan and Wong (2010) develop and empirically tested the Performance based higher education service quality model (PHed) on 360 students from Japanese Universities. Findings of the study indicated that the eight dimensions of Dependability, effectiveness, capability, efficiency, competencies, assurance, unusual situation management and semester and syllabus had a significant influence on student satisfaction.

A new measurement scale known as HiEDQUAL was developed by Annamderula and Bellamkonda (2012) for measuring service quality in the Indian Higher education sector. A sample of 358 students was used and the research findings showed a significant

positive influence of teaching and course content, administrative services, academic facilities, campus infrastructure and support services on the overall students perception of service quality Van Schalkwyk and Steenkamp (2014) explored service quality and its measurement for private higher education institutions in South Africa. A sample of 984 students was used and the SERVQUAL instrument used to collect service quality data. The findings of the study indicated that the five dimensions of the SERVQUAL instrument had a significant influence on the satisfaction and perception of service quality by students at the private higher education institutions.

Poturak (2014) analyzed private universities service quality and students' satisfaction in Bosnia and Herzegovina using a sample of 300 respondents. Findings of this study indicated that service quality at the private universities had a significant effect on the level of students' satisfaction. Mang'unyi and Go vender (2014) examined perceived service quality and customer satisfaction using student's perception of Kenyan private universities using a sample of 522 students. The study used the HEDPERF framework to collect the research data. Their findings indicated that the service quality dimensions had a positive and a significant relationship with service quality dimensions had a positive and significant relationship with service quality which in turn influenced customer satisfaction. Kundi et al (2014) investigated the impact of service and quality on customer satisfaction in higher education institution using a case study of Gomal University in Pakistan and a sample of 200 students. The study used the SERVQUAL instrument and findings showed significant and positive impacts of service quality dimensions on customer satisfaction which is consistent with the findings of previous studies.

However there have been several inconsistencies in the findings of various studies. Douglas et al (2006) measured student satisfaction at a university in England and found that the quality of academic resources were not important in determining students satisfaction. This is not consistent with the findings of a study by Encabo (2011) who studied student perception on instructional quality and satisfaction in Philippines and found that academic resources was the most significant factor influencing student's satisfaction.

Similarly, Tuan (2012) analyzed the effects of service quality and price fairness on student satisfaction in universities in Vietnam. Findings of the study shown that administrative service quality was significantly and positively related to student's satisfaction. On the contrary Ahmed and Masud (2014) examined the service quality and student satisfaction of a higher educational institute in Malaysia and found that administrative services were not academic researches, lecturer quality and quality of academic programmes had a direct and significant relationship with the satisfaction level of the students.

### IV. CONCLUSION AND RECOMMENDATION

Service quality in higher is a multi – dimensional construct and there is no consensus among authors on the dimensions or the best model that should be used evaluate service quality in institutions of higher learning. The existing literature on the service quality construct in higher education identifies many dimensions such as competence of staff, reputation of the institution, delivery styles by tutors and lecturers, reliability,

tangibles, responsiveness, sufficiency of resources, administrative services, and attitude support services among others.

In the studies reviewed, the SERVQUAL instrument has been used the most in the measurement of service quality although newer models such as HEDPERF and HiEdQUAL were developed specifically for measuring service quality in the higher education sector. There is a need for their higher education specific models such as PHed, HEDPERF and HiEdQUAL to be tested more in the African higher education sector in order to validate them in a differed geographical area since most of them have only been tested in Asian countries such as Malaysia, Japan and India.

Effective evaluation of service quality and student satisfaction. In higher education institutions should include both academic and non-academic dimensions that students are exposed to when studying at an institution and these include; teaching and administrative staff competence, staff reliability and responsiveness, staff empathy and assurance, delivery styles used by tutors and lecturers and institution facilities such as libraries, computer laboratories and hostels for institutions that provide boarding facilities for their students. Another important dimension in higher education service quality is the support services especially in the area of counseling and student health in case a student requires medical attention while still at the institution's premises.

The existing literature shows that service quality in higher education has a significant influence on student satisfaction and in view of this, higher education institutions need to be aware of the service quality dimensions that influence the satisfaction of their students and therefore it is important to note that these dimensions should be determined by the students and not the management of the institution because the students are the primary recipients of the services provided by the institutions. Student feedback is also an important component in the evaluation of service quality and student satisfaction and focus groups can be used to identify the key areas of interest to students. Formal questionnaire based surveys and suggestion boxes can be used to collect student feedback on the key dimensions of service quality and student satisfaction. The paper recommends that a study be done to investigate the moderating effect of corporate reputation on the relationship between service quality and student satisfaction.

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# Health Expenditure Distribution and Life Expectancy in Nigeria

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**Abstract-** Improvement in health service delivery is a necessary condition for the enhancement in Human Capital Development and high level of life expectancy. However, this is very hard to achieve especially in developing countries. Therefore, this study examined the relationship between life expectancy and Government Expenditure in Nigeria between 1980 and 2015. The data for the study were sourced from Central Bank of Nigeria and Bureau of Statistics Annual Reports. Vector Autoregressive Distributive Model (VAR) was used as estimation technique. Results from forecast Error Variance Decomposition showed that the highest shocks to the life expectancy were accounted for by the share of government expenditure. The second in rank was the number of physicians and carbon dioxide also contributed immensely to low life expectancy in Nigeria. From the results, the contribution of real growth rate of income was indirect and marginal. Other variables such as Death and Birth rate did not contribute significantly to the life expectancy in Nigeria during the study period. Based on these findings, it is recommended that for life expectancy to increase in Nigeria, the share of government expenditure on health should increase and that plantation of grasses and trees should be encouraged to reduce the effect of carbon dioxide.

**Index Terms-** Life Expectancy, government Expenditure, VAR and Nigeria.

## I. INTRODUCTION

It has been established in the literature that improvement in health service delivery is a necessary condition not only for enhancement in Human Capital Development but also for high life expectancy in every nation both in developed and developing countries. Better health condition improves or shift labour supply curve to the right, increase the level of production and advancement in the performance of macroeconomic variables. Moreover, the extent of share of government expenditure on health to some extent determines the ultimate level of human capital development which then metamorphosizes to a better skillful efficient productive investment in other sectors of the economy. Increase in budgetary allocation to social services is required in developing countries especially Nigeria. Weak and poor budgetary allocation to health sector and poor implementation of health policies have been identified as some of the reasons for high level of poverty, income inequality and low life expectancy, (World Bank 2008).

In Nigeria, despite the relative huge budgetary allocation for health sector, this has not really manifested in the health status of an average Nigerian. The health status of Nigerians is

consistently ranked low. Nigeria is ranked 74<sup>th</sup> out of 115 countries based on the performance of some selected health indicators. ( World Bank, 1999).

Nigeria over all health system performance was equally ranked 187<sup>th</sup> among the 191 member states by the World Health Organization (WHO) in 2006 (National Health Policy, (2008). The infant and child mortality rate in Nigeria are among the highest in the world.

Furthermore, the relationship between share of government expenditure on health and life expectancy is proportional. That is, an improvement or increases in the share of government expenditure on health sector, the increase in the life expectancy. However the average life expectancy for male in Nigeria is forty while that of female is fifty two. (World Bank, 2010).

Empirical findings show that low share of government expenditure on health sector has been discovered to be one of the major reasons for poverty, poor sanitary system, income inequality and low life expectancy.

In addition, as a result of high level of fluctuations in Nigerian government revenue because of oil price shocks, both the recurrent and capital expenditure have been greatly altered over the year. For instance, since 1982 to 1987, the total government expenditure in Nigeria on health sector reduced from 72.9m which was less than ten percent of total budget in 1982 to as low as 17.2m in 1987 which of course was less than five percent of the total budget. However, in 1990, there was a remarkable improvement in share of government expenditure to around 297m in 1991, a reduction was still recorded that dropped to around 137m, also reduced further to 33.72m in 1992. The figures increased steadily to 586.2, 1993, but in subsequent years, the figures reduced till the current fiscal year. It should be noted that the capital expenditure on health follows the same pattern with the recurrent expenditure.

Several studies have been conducted to establish the causal relationship between government expenditure and health both in developed and developing nations. Chris & Gruce (2005), Serdark (2015), Serup (2016). Bakare & Olubokun, (2011) and several others. However, majority of these studies only considered the relationship between the health and macroeconomic variables. Therefore, it is essential to consider the nexus between government expenditure and life expectancy especially in Nigeria.

The rest of the paper is structured as follows; this introductory section is followed by section that discusses conceptual issues and empirical literature. Section three presents theoretical underpinning, methods and materials. Section four centers on results and its interpretation while section five concludes the paper.

## II. CONCEPTUAL ISSUES

### Life Expectancy

This indicates the number of years a person can live before he dies, subject to mortality risk prevailing. This is particularly depends on some factors; for instance, good welfare, high standard of living and good health condition etc. In developing countries is averaged of 35 to 40 years, compared with 62 to 65 years in the developed world. By 2000s, the difference has fallen to 16years as life expectancy in the less developed countries increased to 56 years (a gain of 42%) while the industrial nations had increased to 72 years (an increase of 13%). Today, because of still relatively infant mortality rates, Africa has the lowest life expectancy, 53 years, while the most favorable region in western Europe, where life expectancy at birth now average about 77 years. Nevertheless, for many developing nations, infant mortality rates have reduced dramatically over the past few decades. Todaro, (2000).

**Government Expenditure:** This is known as government consumption, investment, and transfer payment in national accounting. The acquisition by governments of goods and services for current use that directly satisfy the individual or collective needs of the community. Therefore, this is classed as government final consumption expenditure. However, government acquisition of goods and services intend to create future benefits, such as infrastructure investment or research spending, is classed as government investment (government gross capital formation). These two types of government spending on final consumption and on gross capital formation, together constitute one of the major components of Gross Domestic Product Ulevelkwak, (2008) However, government spending can be financed by government borrowing, seignior age, or taxes, changes in government spending is a major component of fiscal policy use to stabilize the macroeconomic performance.

### Empirical Literature

The issue of government expenditure and life expectancy has been so contentious especially in Nigeria. Therefore, some of the previous studies on the topic are hereby presented.

Serdar, (2015) examined the relationship between government expenditure and economic growth in Turkey. The study employed a Feder-Ram Approach as estimation technique. Findings from the study showed that the relationship between Government Health Expenditure and Economic Growth was positive during the study period. That is, when government expenditure on health improves economic growth improves as well as Serap, (2016) studied the relationship between Health expenditure and economic growth in some selected developing countries. A modified version of the Granger (1969) Causality test proposed by Joda and Yammoto (1995) and Dolado and Luthkepoh (1996) was employed as estimation technique. Findings from the study revealed that income is one of the major factors in explaining the difference in healthcare expenditures among countries. This showed that an increases in income level, stimulates healthcare expenditures for some emerging market-economies. In a related study, Bakare and Olubokun (2011) studied Health care expenditure and economic growth in Nigeria. The study applied ordinary least square as estimation technique. Results revealed a significant and positive

relationship between health care expenditure and economic growth in Nigeria during the study period.

Bhargava et al, (2001) examined the effects of health indicators on economic growth rates in the period 1965 to 1990 in some selected developed and developing countries. Panel co-integration was used as estimation technique. Finding from the study showed a positive and statistically significant relationship between health and economic growth in those selected countries. Erdil&Yetkiner, (2009) examined the relationship between Gross Doestic Product and Health expenditure in some selected countries. Pooled panel ordinary least grange causality were employed as estimation techniques. The major causality that runs between health and GDP was bi-directional. That is, increase in health care expenditure improves economic performance and that better economic performance encourages improvement in health care of the selected countries during the study period.

Wang, (2011) investigated the international total health care expenditure data for thirty one nations from 1986 to 2007. Panel regression was used as estimation technique from the results, improvement in health care delivery increases the output growth of selected countries during the study periods.

Mchrara&Musui, (2011) studied the relationship between health expenditure and economic growth for a sample of thirteen Middle East and North Africa countries between 1995 and 2005. The study employed panel co-integration and error correction as estimation technique. Findings from the study revealed a bi-directional relationship between health care expenditure and macro economic performance in selected countries during the study periods.

Bardacc, E.B, (2004) studied the relationship between health expenditure and macro economic performance in some twenty one selected countries. Panel regression was used as estimation technique. Findings revealed that increase in government expenditure on health stimulate economic growth of selected twenty one countries during the study periods.

Gupta & Mitra (2004), investigated the relationship between increased in government expenditure and infant mortality rate. The study used ordinary least square as estimation technique. Findings showed that increase in government health expenditure reduces infant mortality in selected developing nations,

Summarily, from the above empirical literature reviewed majority of the studies were on the relationship between government health expenditure and economic growth. Many of these studies were carried out in advanced countries. Only one or two of them were really on government expenditure on health and mortality rate. Therefore, this study is out to investigate the relationship between government expenditure on health and life expectancy.

### Section Three:

This section deals with theoretical underpinning, methods and materials

### Sources of Data

Data for this study are secondary in nature, sourced from Central Bank of Nigeria, Statistical Bulletin and Bureau of Statistics annual reports.

### Model Specification

From the reviewed of empirical literature and in line with the theoretical framework, below model is being specified to examine the relationship between life expectancy and share of government expenditure in Nigeria. Since our main objective is to examine the relationship between government expenditure and life expectancy. Then, this paper uses the share of government expenditure on health both recurrent and capital expenditure, life expectancy, the real growth rate, the total number of physician, carbon dioxide emission, death and birth rates as variables of interest. The unrestricted VAR model of order P is presented in equation 1

$$Y_E = AY_E + \dots + APY_{1-p} + \beta_E + \epsilon_t$$

$Z_t$  ‡ constant  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6 \& \alpha_7$

Where  $Y_E$  is the vector of endogenous variables  $Z_t$  is the vector of exogenous variables A and B are coefficient matrices. P is an unobservable zero-mean with noise process.  $\alpha_1$  to  $\alpha_7$  are the variables chosen from 1980 to 2015 for the VAR model.

The estimation technique for the study is VAR. this method permits us to study the relative in the changes of other variables. The circumvents the problem involved with the specification and estimation of structural simultaneous equations in another advantage of VAR model. This is because the VAR model considers all variables as endogenous. Our empirical analysis should involve three stages. First, unit root test for the variables, Granger causality test and finally forecast error variance decomposition.

#### Section Four

##### Empirical Analysis and Policy Results

This section deals with empirical results starting with the time series properties of the variables.

##### Unit root test for the variables

The analysis is based on time series data. Therefore, some specific methods are required for the analysis. It is conventional that the econometric estimation of a model based on time series data requires that the series be stationary, as non-stationary series usually results in mis-leading references. To overcome this, Engle and Granger, (1987) provide a standard technique to solve this. This is systematically requires testing the variables of interest for stationarity by running the regressions for all the series both at first difference and at levels. For this stationarity test, Augmented Dickey Fuller (1979) is used. The results of ADF tests are presented in table 4.1 in appendix.

From the unit root test results in table 4.1 in the appendix, not all the variables are stationary at level except MPHU, but became stationary at first difference.

Since the levels of stationarity of the variables of interest have been established through ADF unit root test, we can now proceed to establish the causality that runs between our target variables. That is between government expenditure on health and life expectancy.

##### Granger Causality Analysis

It is required to determine whether government expenditure on health plays an important role in the life expectancy in Nigeria. Therefore, the causality that runs between them should be established. From the Granger Causality test results through pairwise Granger causality test, government expenditure on health shows that at F-ratio of 4.031, the null hypothesis cannot be accepted. Therefore, government expenditure Granger causes life expectancy, real growth rate, child mortality, death rate and total number of physician but the non hypothesis of non-Granger causality between government expenditure and carbon dioxide emission is accepted.

This is because, from table 4.2, government expenditure on health did not Granger cause carbon dioxide. From this Granger causality test result, we can conclude that causality that runs between government expenditure on health and life expectancy is bi-directional. That is, government expenditure Granger causes life expectancy and life expectancy Granger causes government expenditure. The economic implication of this is that when there is an increase in the share of government expenditure on health, life expectancy increases and when life expectancy increases, labour productivity increases and this will eventually stimulates the government income through taxation. Increase in taxation brings more income for government to spend.

##### Forecast Error Variance Decomposition

The series of analysis in the VAR methodology is the forecast Error Variance Decomposition (FEVD). In this wise, we try to determine the percentage of variance in each endogeneous variable that is determined by the other variables. This justifies the amount of influence the endogeneous factors exert on each other. However, table 4.3 in the appendix shows the various results of forecast error variance decomposition.

The variance decomposition suggests that shocks to the government expenditure had the highest influence on life expectancy throughout the period of analysis. It increased steadily and significantly overtime. Government expenditure on health responsible for about six percent shocks to life expectancy in the first quarter increased steadily like that till tenth quarter when it was around twenty five percent. The economic implication of this is that major determinant of life expectancy in Nigeria was the share of government expenditure on health during the study period. This result is in line with the findings of World Health Organization in (2010) which reported that increased in the share of government expenditure on health stimulates the life expectancy not only in developed countries but also, in developing nations. Other variables that had influence on life expectancy are, the total number of medical personnel. The total number of physicians accounted for two percent variation in life expectancy in the first three quarters, increased to about ten percent in seventh quarter, thereafter, the contribution started to reduce. This might be as a result of constant industrial actions by medical personnel due to poor working conditions and non availability of modern health facilities.

Moreover, the empirical result showed that the government expenditure largely explains itself for the first five quarter period of the analysis, therefore, the explanatory power reduced. Specifically, the empirical result showed that life expectancy accounted for the largest variations to the government expenditure. For instance about two percent shocks to

government expenditure was as a results of variation in the life expectancy. This increased steadily to about ten percent in the fifth quarter and by tenth quarter, it accounted for about fifteen percent. The shocks from death and birth rate were not that high. For instance, the shocks from death rate to life expectancy was about one percent from first quarter till sixth quarter but increased to about four percent in the tenth quarter. As regards the shocks from birth rate to life expectancy. This contributed a significant influence for instance, right from first quarter which was around ten percent, this increased to about nineteen percent in the tenth quarter. The shocks from real growth rate responsible for almost fifteen percent variation in life expectancy from first quarter till seventh quarter but this increased to about twenty percent in the tenth quarter. The shocks from carbon dioxide emission accounted for five percent variation in life expectancy in the first five period and increased to around ten percent in the tenth quarter.

Furthermore, as regards the response of variables of interest to shocks emanating from share of government expenditure on health. The shocks from the share of government expenditure on life expectancy was positive and significant from the results. The dynamic responses of life expectancy are persistent but smaller in magnitude in the wake of a shock to share of government expenditure on health. After the share of government on health shock, the life expectancy increase above the steady state level through different channels. The first is increased in total number physician and real growth rate. Although, an increase in the share of government expenditure on health causes the growth rate to increase but both birth rate and carbon dioxide emission increase steadily. The reason for this might be because of an increase in the life expectancy, the level of output increases, increasing in the output level generates more income for individual and this now increases the reproductive power of workers. For carbon dioxide emission, because of increasing and the number of industries and environmental degradation also increases.

### POLICY IMPLICATION ON THE RESULTS

Based on the results from estimated models that are outline in the above sub-section four, the results are instructive and far reaching. Some policies from the results are drawn in the first place, forecast error decomposition results suggests that shocks to the life expectancy in all the ten quarters were accounted considerably for by the share of government expenditure on health. Nigeria as a developing nation, when government expenditure on health improves, the life expectancy increase and vice-versa.

However, this has serious implication on policy formulation and implementation. This shows that one of the major determinant of life expectancy in Nigeria is government expenditure.

Secondly, the results shows that the number of physician do not matter to life expectancy but the income, condition of service of these physicians and other issues such as modern health equipment which is to be determined by the share of government expenditure on health are part of major determinants of life expectancy.

The third aspect of the result is the indirect and marginal impact of real growth rate on life expectancy. The implication of

this is that the transmission mechanism of life expectancy is not actually the growth rate of output but the share of government expenditure on health.

### III. CONCLUSION AND POLICY RECOMMENDATION

This study examined the relationship between life expectancy and government expenditure on health in Nigeria between 1980 and 2015. In the study, some relevant concept were discussed. Also, empirical literature on the topic were presented. From the presentation of these empirical literature, the study was able to discover the existing gaps in the literature. Vector Autoregressive Distributive model was used as estimation technique. From the empirical result based on forecast error variance decomposition, the highest shocks to the life expectancy was accounted for by the share of government expenditure on health. Also, the growth rate of output contributed indirect and marginal input on life expectancy. Two variables were equally contributed significantly to the life expectancy in the study. The variables were, carbon dioxide emission and number of physician.

Based on these findings, it is recommended that for the Nigerian government to achieve high and sustainable life expectancy, the share of government expenditure on health should be increased. Also, to reduce the carbon dioxide emission, planting of trees and grasses should be strength then.

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**Appendix I.**

**Table 4.1: Unit Roots Test Results**

Variables	ADF Lag	ADF test Statistics	95% critical value for the ADF statistics	Remark
LE	1	-0.923121	-2.8801	Non-stationary
HEXP	1	-2.124624	-2.8799	Non-stationary
CHDM	1	-0.0812342	-2.8799	Non-stationary
DHRC	1	-0.0721421	-2.8799	Non-stationary
MPHY	1	-4.321462	-2.8799	Stationary
RCG	1	1.624562	-2.8799	Non-stationary
COZE	1	-0.342126	-2.8799	Non-stationary
LE	1	-6.021462	-2.8800	Stationary
HEXP	1	-7.245621	-2.8800	Stationary
CHDM	1	-5.423241	-2.8800	Stationary
DHRC	1	-5.624123	-2.8800	Stationary
MPHY	1	-6.434567	-2.8800	Stationary
RGR	1	-26.45621	-2.8800	Stationary
COZE	1	-5.221346	-2.8800	Stationary

Note: Dicky Fuller Regressions include an intercept and a linear trend.

# Female Genital Mutilation: Secret Practice in India

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**Abstract-** In this paper I want to explore discrimination faced by women in the world because of their Gender. Gender includes a range of physical, biological and behavioural characteristics pertaining to and differentiating between masculinity and femininity. Gender inequality still exists globally despite of substantial national and international measures that have taken towards Gender equality. At least one in three women around the world is estimated to have been coerced in Sex, physically beaten or otherwise abused in her life time.

In this context the study wants to explore the most harmful practice faced by contemporary women in some parts of the world. That is the practice of Female Genital Mutilation. In spite of global efforts to eradicate Female Genital Mutilation every year 3 million girls are subjected to this harmful practice mostly in Africa and Asia. The barbaric practice is associated with immediate and long term complications and has no benefit what so ever, is unethical and has no religious basis. From this overview, this article outlines the practice of Female genital Mutilation in the context of Indian regions.

**Index Terms-** “Barbaric”, “Circumcision”, “ Female”, “Genital”, “Gender”, “Mutilation”, “Sex”

## I. INTRODUCTION

In the name of Gender the women have been discriminated throughout the world. This can be estimated by the fact that although females represent half of the world’s people, women and girls make up 70 percent of the world’s poor and two-thirds of the world’s illiterate population.<sup>i</sup>

Because of her Gender women have been subjugated by many ways as Women throughout the globe lack support for fundamental functions of a human life. They are under nourished than men, less healthy, more susceptible to physical cruelty and sexual abuse. They are much less likely than men to be literate, and still less likely to have paraprofessional or technological education. They face great hurdles, including pressure from family or spouse, sex intolerance in hiring, and sexual aggravation in the workplace without effective legal recourse.<sup>ii</sup>

One of the most inhuman practices faced by women’s in some regions of the world is *Female Genital Mutilation* also known as *Female Genital Cutting* and *Female Circumcision*. This practice is carried out by some communities who believe that it reduces a women’s libido. This practice is performed just after the girl attains puberty or before puberty. The World Health Organization has defined it as “all procedures that involve partial or total removal of the external female genitalia or other injury to the female genital organs for non-medical reasons”. The WHO estimates that 100–140 million women and girls around the world have experienced this procedure

including 92 million in Africa . According to WHO *FGM* can be categorised into four types according to the extent of the injury: type I includes removal of the Clitoral hood, type II, includes removal of the Clitoris and inner labia, type III is removal of all or part of the inner and outer labia and usually the clitoris and fusion of the wound leaving a small hole for the passage of urine and menstrual blood. The fused wound is opened for intercourse and childbirth.<sup>iii</sup>

This barbaric practice is prevalent still and is know by the fact that around globally 100–140 million girls have been subjected to Female Genital Mutilation this data according to World Bank as discussed above. In spite of global efforts to eradicate the practice, but it is still prevalent.<sup>iv</sup>This practice is mostly practised by Diaspora communities round the world though and it is concentrated in 29 African countries, certain ethnic groups in Asia (India, Indonesia, Malaysia, Pakistan and Sri Lanka), the Middle East (Oman, the United Arab Emirates, Yemen, Iraq, Palestine and Israel), and South America (Columbia, Ecuador and Peru).<sup>v</sup>

This reason for performing this barbaric practice is that as it has been known that sexual behaviour is a result of interaction of biology and psychology. Sexual excitement of the female can be triggered by stimulation of erotogenic areas; part of which is the clitoris. Female circumcision is done to minimize sexual desire and to preserve virginity.<sup>vi</sup>

## II. CONTEXTUAL UNDERSTANDING

In the Indian society the Gender discrimination continues to be an enormous problem. The women have been relegated to the secondary status both within the household and workplaces due to the presence of Traditional patriarchal norms.<sup>vii</sup>

The patriarchal structure of society in India is responsible for the gender inequality. In the words of famous sociologists **Sylvia Walby**, patriarchy is “a system of social structure and practices in which men dominate, oppress and exploit women”. Discrimination against women in Indian society is an age old phenomena. The religious beliefs, whether it is Hindu, Muslim or any other religion gives legitimacy to the system of patriarchy. For example, as per ancient Hindu law giver **Manu**: “Women are supposed to be in the custody of their father when they are children, they must be under the custody of their husband when married and under the custody of her son in old age or as widows. In no circumstances she should be allowed to assert herself independently”. In the contemporary Indian society the above description of Manu is still relevant in some cases. Except certain section were women are independent and they can take part their decision by own. In Muslims also the situation is same and there too sanction for discrimination or subordination is provided by religious texts and Islamic

traditions. Similarly in other religious beliefs also women are being discriminated against in one way or other.<sup>viii</sup>

The Female genital mutilation is probably one of the biggest secrets of modern Indian discrimination or rather we can say inhuman treatment against women. In India, it is widely practiced by the Dawoodi Bohra community, a sect of the Shia-Muslims, who are led by the Syedna. This barbaric practice is locally termed as 'Khatna'. Some of the reasons include family honour, increasing sexual pleasure for the male, enhancing fertility, [social acceptance](#) and preservation of virginity. If we take the Indian context such operations usually take place in the [Mullanis](#) house, and those who practice it are given permission from the clergy of Dwoodi Bohra sect. This Barbaric practice is also prevalent in the Bohra community in Pakistan.

The matter, even though unjust, gets buried inside the girls' mind like any normal process. The women are made to believe that FGM is necessary to ensure acceptance by their community and are unaware that FGM is not practiced in most of the world. Because of the patriarchal structure makes women are either too afraid or too embarrassed to raise their voice against such oppression.<sup>ix</sup> The girl's circumcision has been kept an absolute secret not only from outsiders but also from the men of the community<sup>x</sup>

### III. CONSEQUENCES OF THIS BARBARIC PRACTICE

The victims of this practice complaint of many health complications such as severe bleeding, tetanus, infections and some cases of frigidity. Because the practice is performed with a razor and the perpetrators often used [abeer](#) or [kapurkanchi](#) powder mixed with silk thread ashes to put over the clitoris after cutting takes place for its cooling effect and for its adhesive value. Which is totally unhygienic?<sup>x</sup>

The other health hazards include severe pain and shock, complications in pregnancy and childbirth, sexual dysfunction, difficulties in menstruation and [psychological damages](#) among many consequences. In addition to these there are considerable psychosexual, psychological and social consequences of *FGM*.<sup>xi</sup> Women undergone this barbaric practice of FGM faced a significantly greater risk of requiring a Caesarean section, an episiotomy and an extended hospital stay, and also of suffering post-partum haemorrhage. Women who have undergone infibulation suffer from prolonged and obstructed labour, sometimes resulting in foetal death and [obstetric fistula](#). The infants of mothers who have undergone more extensive forms of FGM are at an increased risk of dying at birth.

There is also a high risk of HIV transmission in the women undergone the process. Because the procedure is coupled with blood loss, and because one instrument is often used for a number of operations, FGM increases the risk of HIV transmission. This is particularly the case in communities where a large group of girls are cut the same day as part of a socio-cultural rite.<sup>xii</sup>

### IV. ADDRESSING THE DISCRIMINATION BY UNITED NATION

Achieving Gender Equality is a goal has been accepted by governments, regional and international organizations. Any new

developmental structure must prioritize Gender empowerment primarily because of the persistent injustice faced by women around the world with women disproportionately representing among the poorest and most marginalized. It is enshrined in international agreements and commitments. The creation of a body of international human rights law is one of the United Nations great achievements. The United Nations has helped negotiate more than 70 human rights treaties and declarations—many focused on the rights of vulnerable groups such as women, children, persons with disabilities, minorities and indigenous peoples. Together, these treaties and declarations have helped create a 'culture of human rights' throughout the world, providing a powerful tool to protect and promote all rights.<sup>xiii</sup>

Far reaching commitments to women rights are encapsulated in core international human rights instruments including the UN convention on the elimination of all forms of discrimination against women (CEDAW) as well as Beijing Declaration also in Millennium Development Goal, UN Security council Resolutions 1325, 1820, 1888 and 1889.<sup>xiv</sup> *Female genital mutilation (FGM)* is recognized internationally as a violation of the human rights of girls and women. February 6th is International Day of Zero Tolerance for *Female Genital Mutilation*. Ending FGM by 2030 is one of the UN Global Goals. In December 2012, the UN General Assembly adopted a resolution on the elimination of *Female Genital Mutilation*. The resolution was passed unanimously and India was part of this unanimous decision. Several countries in the world have banned the practice of FGM. Nigeria is the latest country which recently passed a law banning FGM, taking the total of countries banning this Practice to 23 in Africa alone.<sup>xv</sup>

Laws against the practice also exist in at least 12 countries with immigrant populations from countries that practice FGM. Very recently, the United States passed a federal law making it illegal for girls to be taken out of the United States for the purpose of performing FGM. Funding for efforts to end FGM has also increased--from less than one percent of UNICEF's budget in 1993, when Equality Now [started a campaign](#) calling on UN agencies to address this serious violation of human rights--to millions of dollars today.

### V. CONCLUSION AND SUGGESTIONS

On the basis of gender, unfavourable treatment of individuals denies the rights, opportunities or resources to a particular section of society. Throughout the globe, women are treated unequally and less value is placed on their lives as compared to men because of their gender. Women's degree of difference, right to use to power and control of possessions is central to this discrimination in all institutional spheres, i.e. the family circle, community, market, and state. In spite of institutional discrimination there is barbaric practices as *Female genital mutilation* which has health and social hazard and stigma, the effects of which do not only affect its victims, but its repercussion reaches the other partner, the family and the community at large also. India is generally considered to be third world where the women have given the secondary status. It has to be condemned by all, and there must be a target in the coming few years to ban it at the level of all the Indian health authorities as well as the Indian governments.

In order to solve this issue following suggestions can go long way in bringing about a change in entire belt.

1 Nothing has changed since. This barbaric practice goes on unchecked to this day, and I believe legal intervention is necessary as soon as possible. Establishment of sufficient number of courts in the state to deal with the cases related to women and to resolve chronic as well as fresh cases of discrimination.

2 Develop among women awareness about their rights and obligations in all the fields of life. While this process may be carried out in the schools, Families and education.

3 The need to widen the circle and strengthen our alliance: In the last decade, it has become increasingly apparent that the involvement of younger generation in women's rights, development and social justice works is absolutely necessary. Many activists and professionals are reaching the last stretches of their carriers, making it essential to foster the transfer the transfer of knowledge between generations and regions in order to sustain and built upon efforts to date.

4 Marketing feminism: In many parts of the world, there is a negative stigma associated with feminism: some say, for example, it is too angry and anti-male, it is about victims

and complaints, or worse, it is irrelevant. This image problem inhabits our success. We need to broaden the movement by attracting new alliance from all sectors, ages and identities.

5 To make lasting change for girls, first, governments need the political will to match their words with action. Enactment of laws against FGM is only the first step. Too many governments are failing to properly implement their laws or to educate their citizens about the laws as Kenya's and Nigeria.

6 Efforts to end FGM must be rooted in the recognition that FGM arises due to gender inequality and the lower status of women in society. As such, anti-FGM efforts must include work to create equality between men and women, girls and boys.

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## STRONGLY REGULAR FUZZY GRAPH

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**Abstract:** In this paper, strongly regular fuzzy graph which is analogous to the concept of strongly regular graph in crisp graph theory is introduced and examples are presented, necessary and sufficient condition for a cycle to be strongly regular fuzzy graph is provided and some properties of strongly regular fuzzy graph are studied.

**Keywords:** degree of a vertex, regular fuzzy graph, effective fuzzy graph, strongly regular fuzzy graph, line graph of a strongly regular fuzzy graph.

**2010 Mathematics Subject Classification:** 05C07, 05C72

### 1. INTRODUCTION:

Fuzzy graph theory was introduced by Azriel Rosenfeld in 1975. Though it is very young, it has been growing fast and has numerous applications in various fields. In this paper we introduce strongly regular fuzzy graphs and we provide a necessary and sufficient condition for a cycle to be strongly regular. Then we study about the line graph of a strongly regular fuzzy graphson a cycle.

### 2. PRELIMINARIES:

Throughout this paper  $n$  denotes the number of vertices of a fuzzy graph and edge between  $u$  and  $v$  is denoted as  $uv$ .

#### **Definition2.1[3]:**

Let  $V$  be a non-empty set. The triple  $G = (V, \sigma, \mu)$  is called a fuzzy graph on  $V$  where

$\sigma: V \rightarrow [0,1]$  and  $\mu: VXV \rightarrow [0,1]$  such that  $\mu(uv) \leq \sigma(u) \wedge \sigma(v)$  for all  $uv \in VXV$ . The underlying crisp graph of  $G :(\sigma, \mu)$  is denoted by  $G^* : (V, E)$

**Definition2.2[9]:**

Let  $G = (V, \sigma, \mu)$  be a fuzzy graph, Two vertices  $u$  and  $v$  in  $G$  are called adjacent if  $\mu(uv) > 0$

**Definition2.3[2]:**

Let  $G = (V, \sigma, \mu)$  be a fuzzy graph. Then  $G$  is said to be effective fuzzy graph if  $\mu(uv) = \sigma(u) \wedge \sigma(v)$  for all  $uv \in VXV$

**Definition2.4[3]:**

A fuzzy graph  $G: (V, \sigma, \mu)$  is called complete  $\mu(uv) = \sigma(u) \wedge \sigma(v)$  for all  $u, v \in V$

**Definition2.5 [4]:**

The complement of a fuzzy graph  $G = (V, \sigma, \mu)$  is a fuzzy graph  $G^c = (V, \sigma^c, \mu^c)$  where

$$\sigma^c(u) = \sigma(u) \text{ for all } u \in V \text{ and}$$

$$\mu^c(uv) = \sigma(u) \wedge \sigma(v) - \mu(uv) \text{ for all } uv \in V$$

**Definition2.6 [4]:**

Let  $G = (V, \sigma, \mu)$  is a fuzzy graph with underlying graph  $G^*(V, E)$

The fuzzy line graph of  $G$  is  $L(G): (\omega, \lambda)$  with underlying graph  $(Z, W)$

Where  $Z = \{S_x = \{x\} \cup \{u_x, v_x\} / x \in E, x = u_x v_x, u_x, v_x \in V\}$ ,

$W = \{(S_x, S_y) / S_x \cap S_y \neq \emptyset, x, y \in E, x \neq y\}$ ,

$\omega(S_x) = \mu(x) \forall S_x \in Z$  and

$\lambda(S_x S_y) = \mu(x) \wedge \mu(y)$  for every  $(S_x, S_y) \in W$

For the sake of simplicity, the vertices of  $L(G)$  may be denoted by  $x$  instead of  $S_x$  and the edges by  $xy$  instead of  $S_x S_y$ .

**Definition2.7 [1]:**

Let  $G = (V, E)$  be a graph Then  $G$  is said to be strongly regular if it satisfies the following axioms

- i)  $G$  is a  $k$ -regular.
- ii) There exists  $\lambda$  number of common neighbours between the adjacent vertices.
- iii) There exists  $\mu$  number of common neighbours between the non-adjacent vertices.

Any strongly regular graph  $G$  is denoted by  $G: (n, k, \lambda, \rho)$ .

**Lemma 2.8[5]:**

Let  $G :(\sigma, \mu)$  be a fuzzy graph on  $G^* :(V, E)$ . If  $d_G(v) = k \forall v \in V$  then  $G$  is said to be  $k$ - regular fuzzy graph.

**Lemma 2.9[5]:**

Let  $G :(\sigma, \mu)$  be a fuzzy graph on an odd cycle then  $G$  is regular iff  $\mu$  is a constant function.

**Lemma 2.10[5]:**

Let  $G :(\sigma, \mu)$  is a fuzzy graph on an even cycle then  $G$  is regular iff either  $\mu$  is a constant function or alternate edges have same membership values.

**Definition 2.11[6]:**

Let  $G$  be a fuzzy graph. The sequence  $(d_1, d_2, d_3, \dots, d_n)$  with  $d_1 \geq d_2 \geq d_3 \geq \dots \geq d_n$ , where  $d_1, d_2, d_3, \dots, d_n$  are the degree of the vertices of  $G$ , is the degree sequence of a fuzzy graph  $G$ .

**Definition 2.12[6] :**

The set of distinct positive real numbers occurring in a degree sequence of a fuzzy graph is called its degree set

**Definition 2.13 [7]:**

In a fuzzy graph  $G: (\sigma, \mu)$ , the degree of an edge  $e = uv \in V$  is  $d(uv) = d(u) + d(v) - 2\mu(uv)$ .  $G$  is an edge regular fuzzy graph if all the edges have the same edge degree.

### 3. STRONGLY REGULAR FUZZY GRAPH

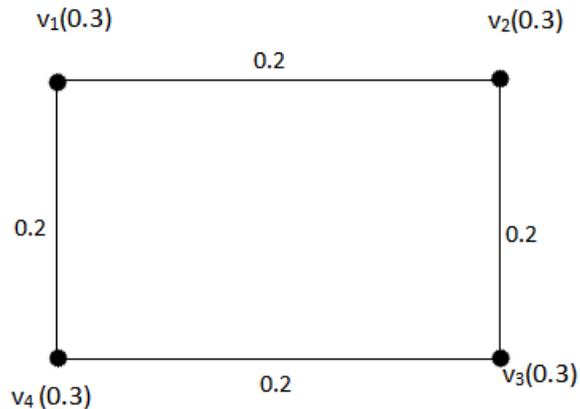
**Definition 3.1:**

A fuzzy graph  $G: (\sigma, \mu)$  is said to be strongly regular if it satisfies the following axioms:-

- i)  $G$  is a  $k$ -regular fuzzy graph
- ii) Sum of membership values of the vertices common to the adjacent vertices  $\lambda$  is same for all adjacent pair of vertices,
- iii) Sum of membership values of the vertices common to the non-adjacent vertices  $\rho$  is same for all non-adjacent pair of vertices

Any strongly regular fuzzy graph  $G$  is denoted by  $(n, k, \lambda, \rho)$  srregular fuzzy graph.

**Example:**



$G: (4, 0.4, 0, 0.6)$

**Fig: 3.1**

**Theorem3.2**

Let  $G$  be a fuzzy graph such that  $G^*$  is strongly regular. Then  $G$  is strongly regular if both  $\sigma$  and  $\mu$  are constant functions.

**Proof:**

Let  $(G^*, k, \lambda, \rho)$  be a strongly regular graph.

Let  $\sigma(u) = c$ , a constant  $\forall u \in V$  and  $\mu(uv) = \iota$ , a constant  $\forall uv \in E$

Now  $d_G(u) = \sum_{uv \in E} \mu(uv)$

$$= \sum_{uv \in E} \iota$$

$$= d_{G^*}(u) \iota$$

$$= k \iota.$$

$\therefore G$  is a  $k \iota$  regular fuzzy graph.

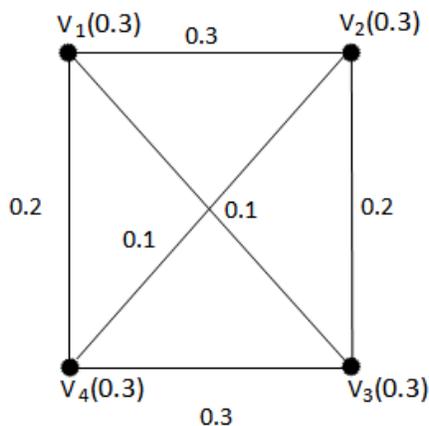
Similarly, since  $\sigma$  is a constant function, the other parameters are  $\lambda c$  and  $\rho c$ .

$\therefore G$  is a strongly regular with the parameters  $k \iota, \lambda c$  and  $\rho c$ .

**Remark 3.3:**

But the converse of the above theorem need not be true

In the following fig.3.2,  $G$  is  $(4, 0.6, 0.6, 0)$  strongly regular,  $G$  is  $(4, 3, 2, 0)$  strongly regular and  $\sigma$  is a constant but  $\mu$  is not a constant function.



**$G: (4, 0.6, 0.6, 0)$**

**Fig: 3. 2**

**Theorem 3.4:**

Let  $G: (\sigma, \mu)$  be a  $(n, k, \lambda, \rho)$  srtrongly regular fuzzy graph then the degree sequence of  $G$  is a constant sequence  $(k, k, \dots, k)$  of  $n$  elements.

**Proof:**

Since  $G$  is a  $(n, k, \lambda, \rho)$  strongly regular fuzzy graph,  $G$  is a  $k$ -regular .  
 Therefore all the vertices have same degree  $k$ .  
 Hence the degree sequence is  $(k, k, \dots, k)$ .

**Theorem 3.5:**

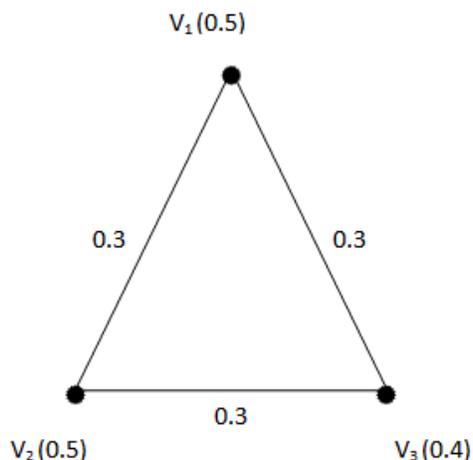
Let  $G: (\sigma, \mu)$  be a  $(n, k, \lambda, \rho)$  srtrongly regular fuzzy graph then the degree set of  $G$  is the singleton set  $\{k\}$ .

**Proof:**

Since  $G$  is -  $k$  regular, all the vertices have same degree  $k$  .  
 Therefore the degree set of  $G$  is  $\{k\}$ .

**Remark 3.5:**

The converse of theorem 3.4 and theorem 3.5 need not be true. For example consider the fuzzy graph  $G$  in the fig 3.3 has the constant degree sequence  $(0.6, 0.6, 0.6)$  , degree set is  $\{0.6\}$  which is not strongly regular.



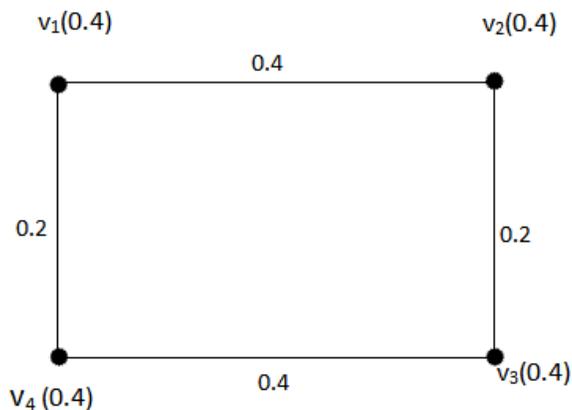
$G: (\sigma, \mu)$

**Fig.3.3**

**Remark 3.6:**

If  $G$  is strongly regular then its edge degree sequence need not be a constant sequence .

This can be verified by the strongly regular fuzzy graph  $G$  in the following fig.3.4.



$G: (4, 0.6, 0.8, 0.8)$

**Fig: 3. 2**

Edge degree sequence of  $G$  is  $\{0.8, 0.4\}$

**Theorem 3.7:**

Let  $G: (\sigma, \mu)$  be a strongly regular fuzzy graph such that  $\mu$  is a constant function then the edge degree sequence of  $G$  is a constant sequence and the edge degree set is the singleton set.

**Proof:**

Since  $G$  is strongly regular,  $G$  is  $k$ -regular . Given

$$\Rightarrow d_G(u) = k \forall u \in V$$

$$\begin{aligned} \text{Therefore } d_G(uv) &= d_G(u) + d_G(v) - 2\mu(uv) \\ &= k + k - 2\mu(uv) \\ &= 2k - 2c \forall uv \in E. \end{aligned}$$

Hence the edge degree sequence of  $G$  is a constant sequence and its edge degree set  $\{2k-2c\}$ .

**4. STRONGLY REGULAR FUZZY GRAPH ON CYCLES**

**Theorem 4.1:**

Let  $G$  be a fuzzy graph such that  $G^*$  is an odd cycle. Then  $G$  is strongly regular iff both  $\mu$  and  $\sigma$  are constant functions and  $n \leq 5$ .

**Proof:**

Let  $G$  be a strongly regular fuzzy graph. Since  $G^*$  is an odd cycle,  $n \geq 3$ .  
 Suppose that  $G^*$  is a cycle  $v_1e_1v_2e_2v_3e_3.....v_n e_n v_1$ , where  $n \geq 6$ .  
 Consider the non-adjacent vertices  $v_1$  and  $v_3$ . Then  $v_2$  is the only vertex common to  $v_1$  and  $v_3$ . Therefore the sum of membership values of the vertices to the non-adjacent vertices  $v_1$  and  $v_3$  is  $\sigma(v_2)$ .  
 Since  $n \geq 6$ , no vertex is common to the non-adjacent vertices  $v_1$  and  $v_4$ . Therefore the sum of membership values of the vertices common to the non-adjacent vertices  $v_1$  and  $v_4$  is 0. Therefore  $G$  is not a strongly regular, which is a contradiction. Hence  $G$  is an odd cycle with  $n \leq 5$ .  
 Suppose  $\mu$  is not a constant function. Then  $G$  cannot be a regular fuzzy graph by lemma 2.8.  
 To prove that  $\sigma$  is a constant function.

When  $n = 3$ , each vertex is common to the other two adjacent vertices, therefore, since  $G$  is strongly regular, all the three vertices must have the membership value. Hence  $\sigma$  is a constant function.

When  $n = 5$ , each vertex is the only vertex common to its neighbours which are non-adjacent. Since  $G$  is strongly regular, all the five vertices must have the same membership value. So  $\sigma$  is a constant function.

Conversely, if  $\mu$  is a constant function then  $G$  is regular by the lemma 2.8,

Let  $\mu(uv) = k$  be a constant and  $\sigma(u) = c$  be a constant  $\forall u \in V$ .

When  $n = 3$ , Sum of membership values of the vertices common to a pair of adjacent vertices is  $c$ . The other parameter is 0. So  $G$  is  $(3, 2k, c, 0)$  strongly regular fuzzy graph.

Similarly, When  $n=5$   $G$  is  $(5, 2k, 0, c)$  strongly regular fuzzy graph.

#### **Theorem 4.2:**

Let  $G$  be a fuzzy graph such that  $G^*$  is a cycle with  $n = 4$ . Then  $G$  is strongly regular iff either  $\mu$  is a constant function or alternate edges have same membership values and sum of membership values of the diagonally opposite vertices are equal.

#### **Proof:**

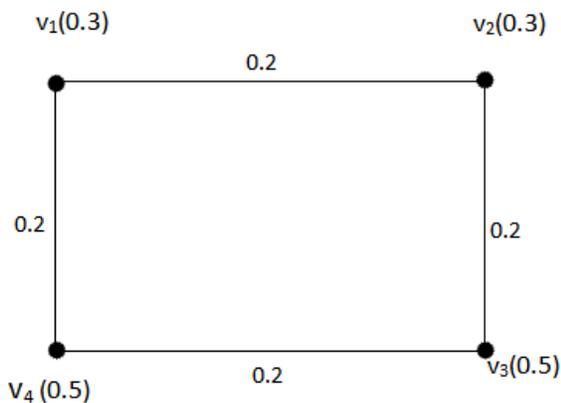
Suppose that  $G$  is a strongly regular fuzzy graph. Then by the lemma 2.9, either  $\mu$  is a constant function (or) alternate edges have same membership value. Since  $G$  is a cycle with  $n = 4$ , the sum of membership values of the diagonally opposite vertices is the sum of membership values of the vertices common to a pair of non-adjacent vertices, which are equal.

Conversely, since  $\mu$  is a constant function or alternate edges have same membership values,  $G$  is a regular fuzzy graph. The vertices common to a pair of non-adjacent vertices are diagonally opposite. Therefore by our assumption, sum of membership values of the vertices common to a pair of non-adjacent vertices is the same. Also no vertices common to any pair of adjacent vertices. Hence  $G$  is strongly regular.

#### **Remark 4.3:-**

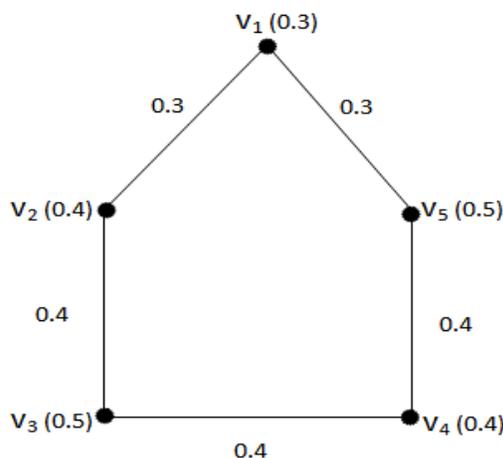
Every strongly regular fuzzy graph on a cycle need not be an effective fuzzy graph and vice versa.

It can be illustrated by the following example. Fig.4.1 is strongly regular but not effective and fig.4.2 is effective but not strongly regular.



$G: (4, 0.4, 0, 0.8)$

**Fig: 4.1**



**Fig: 4.2**

**Theorem 4.4:**

Let  $G :(\sigma, \mu)$  be an effective fuzzy graph on an odd cycle with  $n \leq 5$ . Then  $G$  is strongly regular iff  $\sigma$  is a constant function.

**Proof:**

Let  $G :(\sigma, \mu)$  be an effective and strongly regular fuzzy graph on an odd cycle.

Then by theorem 4.1,  $\sigma$  is a constant function.

Conversely let  $G$  be an effective fuzzy graph with  $\sigma$  as a constant function and  $n \leq 5$ .

Let  $\sigma(u) = C \forall u \in V$ .

Since  $G$  is effective,  $\mu(uv) = \sigma(u) \wedge \sigma(v) \forall u, v \in E$ .  
 $= C \forall u, v \in E$ .

Hence  $\sigma$  and  $\mu$  are constant functions in  $G$ .

Therefore  $G$  is strongly regular fuzzy graph by the theorem 4.1.

**Theorem 4.5:**

Let  $G :(\sigma, \mu)$  be an effective fuzzy graph on cycle with  $n \leq 5$  such that  $\sigma$  and  $\mu$  are constant functions. Then the degree sequence and edge degree sequence of  $G$  are constant sequences.

**Proof:**

Let  $G :(\sigma, \mu)$  be an effective fuzzy graph on a cycle  $C: v_1, v_2, v_3, \dots, v_n, v_1$  with  $n \leq 5$  such that  $\sigma$  and  $\mu$  are constant functions.

If  $n = 3$  (or)  $5$  then by theorem 4.4,  $G$  is strongly regular. Hence the degree sequence is a Constant sequence.

If  $n=4$ , then by theorem 4.2,  $G$  is strongly regular .Hence the degree sequence is a Constant sequence.

Since  $G$  is a cycle, the degree of each edge in  $G$  is the sum of the membership values of two edges incident on it .Here  $\mu$  is a constant function, therefore the edge degree sequence of  $G$  is a constant sequence.

**Theorem 4.6:**

Let  $G :(\sigma, \mu)$  be an effective fuzzy graph on a cycle such that  $\sigma$  is a constant function. Then the degree sequence and edge degree sequence of  $G$  are constant sequences. Hence the degree set and edge degree set of  $G$  are singleton sets.

**Proof:**

Let  $G:(\sigma, \mu)$  be an effective fuzzy graph on a cycle  $G^*:v_1, v_2, v_3, \dots, v_n, v_1$  such that  $\sigma$  is a constant function. Then  $\mu$  is also a constant function.

Since  $G^*$  is a cycle, the degree of each vertex in  $G$  is the sum of the membership values of two edges incident on it and the degree of each edge in  $G$  is the sum of the membership values of two edges adjacent to it. Therefore if  $\mu$  is a constant function of constant value  $k$ , then  $G$  is a  $2k$ -regular and  $2k$ -edge regular fuzzy graph. Therefore the degree sequence and the edge degree sequence of  $G$  are constant sequences.

**Corollary 4.6:**

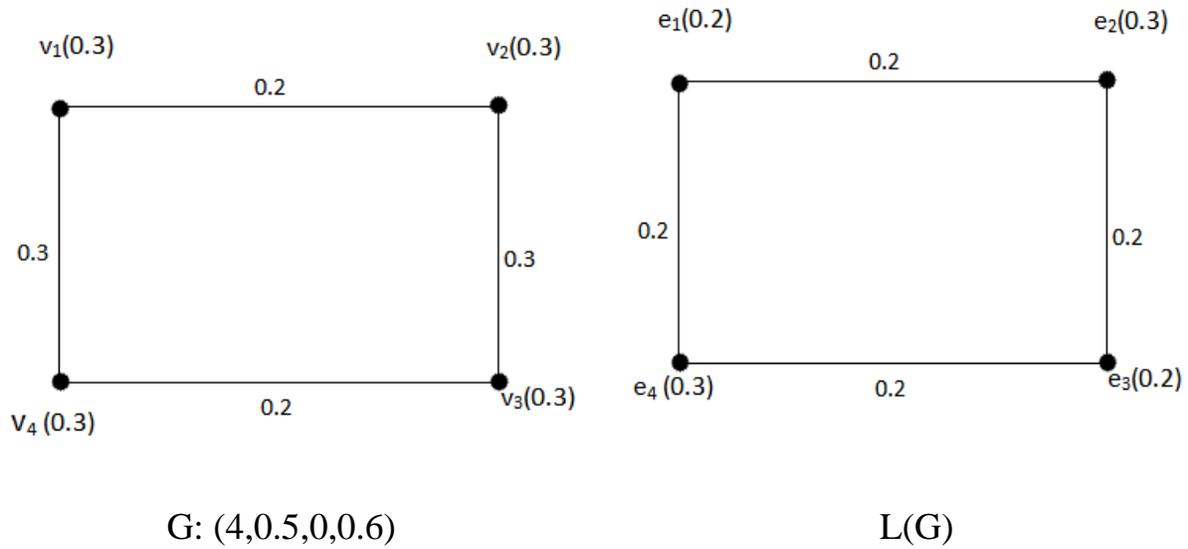
Let  $G :(\sigma, \mu)$  be an effective fuzzy graph on a cycle such that  $\sigma$  is a constant function. Then the degree set and edge degree set of  $G$  are singleton sets.

**5. LINE GRAPH OF STRONGLY REGULAR FUZZY GRAPH ON YCLES**

**Remark5.1:**

If  $G$  is a strongly regular fuzzy graph on a cycle then  $L(G)$  need not be strongly regular.

This can be seen from the following figure 5.1

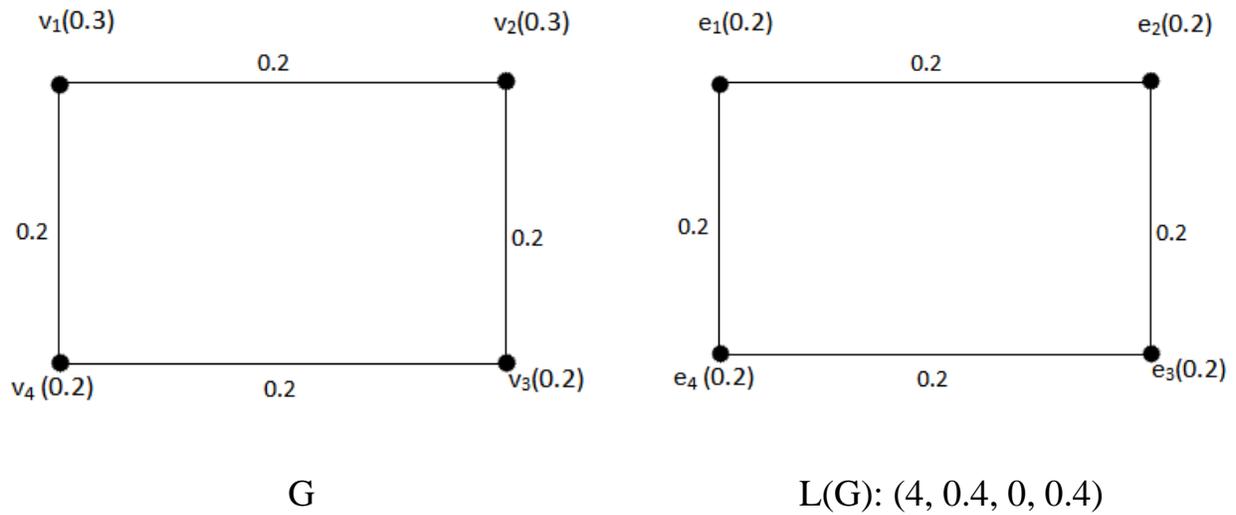


**Fig: 5.1**

**Remark5.2:**

If  $L(G)$  is a strongly regular fuzzy graph on a cycle then  $G$  need not be strongly regular.

This can be seen from the following figure 5.2



**Fig: 5.2**

### Theorem 5.3:

If  $G: (\sigma, \mu)$  is a strongly regular fuzzy graph on a cycle  $G^*$ , then  $L^m(G)$  is a strongly regular fuzzy graph for every positive integer  $m$ .

### Proof:

Let  $G: (\sigma, \mu)$  be a strongly regular fuzzy graph on a cycle with  $n$  vertices.. Then by the theorem 4.1,  $3 \leq n \leq 5$  and  $\sigma$  and  $\mu$  are constant functions.

Let  $\mu(uv) = k$ , a constant,  $\forall uv \in E$  and  $\sigma(u) = c$ , a constant,  $\forall u \in V$ .

Then in  $L(G)$ ,  $L^2(G)$ , ...,  $L^n(G)$ , ..., the vertex membership functions and the edge membership functions are all constant functions of same constant value  $c$

Also if  $G^*$  is a cycle with  $n$  vertices,  $L^m(G^*)$  is also a cycle with  $n$  vertices for every positive integer  $m$ .

Since  $G^*$  has  $n$ ,  $3 \leq n \leq 5$ , vertices,  $L^m(G^*)$  also has  $n$ ,  $3 \leq n \leq 5$ , vertices for every positive integer  $m$ .

Hence  $L^m(G)$  is a strongly regular fuzzy graph for every positive integer  $m$ .

## 6. CONCLUSION

In this paper we have defined strongly regular fuzzy graph and we have found the necessary and sufficient condition for a cycle to be strongly regular. Also we have derived the necessary and sufficient condition for line graph of a strongly regular fuzzy graph to be strongly regular and discussed about degree sequence, edge degree sequence of strongly regular fuzzy graphs.

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# Comparative Biogenecity of Soil Samples from Various Ecosystems of Palakkad District, Kerala, India

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**Abstract-** Soil organisms are an integral part of agricultural ecosystems. The presence of a range of diverse community of soil organisms is essential for the maintenance of productive soil (Anderson 1975). Present study reviews the abundance, species richness and factors that cause these parameters to vary, of soil fauna in different ecosystems of Palakkad district Kerala, studied as a part of International Year of Soil 2015. The concept that anthropogenic activities act within soil communities is reviewed in the light of these findings, which are placed in the context of the wide literature relating to earthworm, ant and termite diversity, and factors that influence these with particular reference to land management. For the study, different ecosystems of Palakkad district was selected, soil from each ecosystem was extracted uniformly and the soil parameters such as pH, water holding capacity and soil fauna were noted. The influence of edaphic factors on soil faunal diversity is discussed in the context of these studies. We conclude that, even though edaphic factors influence the faunal diversity, human interaction is potentially the main cause of variation. The most profound impacts of human modification of soil was the reduction in key species diversity and their evenness. Habitat heterogeneity and agroforestry conditions which influences the distribution and abundance of soil fauna. In this study, taxonomic richness and abundance of soil fauna was higher in the tree-based systems compared to the annual crops and the agroforestry condition maintain the soil fauna.it help to maintaining of productive soil.

**Index Terms-** Agroforestry, Anthropogenic factors, Ecosystems, Soil fauna, Tree based ecosystems

## I. INTRODUCTION

From the moment a natural system is modified by human activities. The agricultural practices are altered to suit human needs and changing agricultural paradigms. Many studies have been performed on the effect of various agricultural practices on the soil fauna and the general trends of these effects. First of all, soil organisms are one of the least concerned and revealed organisms in the scientific world even though a large percent of soil invertebrates have been enlisted in red data book published by the IUCN (Daniel et al.1998). So, if more studies are done considering soil organisms, more relevant information may be disclosed and this can certainly help in providing proper attention as well as practicing appropriate strategies for their conservation.

soil organisms are responsible for a range of ecological functions and ecosystem services including nutrient cycling,

nitrogen fixation, control of pest and diseases, carbon sequestration ,maintenance of a good soil structure for plant growth and rain water infiltration, detoxification of contaminants (Swift et al.1979).An excessive reduction in soil biodiversity, especially the loss of species with key function, may result in severe effects including the long term degradation of soil and the loss of agricultural productive capacity. Soil health and soil quality are fundamental to the sustained productivity and viability of agricultural systems worldwide. Agroecosystems are one of the most productive man made ecosystems. It plays an important role in the production of food. The agroecosystems maintain and protect biodiversity for the coexisting cultivated plants and associated biota including microflora and fauna. Each and every organisms are interrelated by food chains and food webs. Depletion of biodiversity destroys the equilibrium of agroecosystem.

In both natural and agricultural systems soil organisms perform vital functions in the soil. The interaction among organisms enhance many of these functions, which are often controlled by the enormous amount of organisms in soil. These functions range from physical effects such as regulation of soil structure and edaphic water regimes, to chemical and biological process. Diversity in natural communities is a key factor in ecosystems structure and function. Disturbance can alter the diversity of an ecosystem directly by affecting survivorship of individual or indirectly by changing resource level. Sometimes diversity measurements reflect the result of disturbance caused by ecological stress. For sustainable land use there is an urgent need for a better understanding of the interaction between the different groups of organisms inhabiting the soil. Human effects on particular soil organisms may lead to changed condition for other organisms below and above ground, which can then cause changes in both soil communities' composition and soil function (Lavelle & Spain 2001).

## II. MATERIALS AND METHODS

A total of ten ecosystems were selected from Palakkad district and 15 soil samples were collected from each in order to identify the soil characteristics and faunal diversity of these ecosystems. The selection of ecosystem using such parameter like ecosystem nature, level of anthropogenic activities, plantation type etc. The random soil samples taken were of 15×15×15 cm in dimension (Monolith samples) (Swift & Bignell.2001). The soil colour and texture was noted and the sample was weighed from the field itself. The soil organisms

were collected from the sample using appropriate method. Furthermore, their corresponding pH and water holding capacity was determined accordingly.

Different types of selected ecosystems where: Arecanut, Banana plantation, Coconut, Grassland, Household, Paddy field, Rubber plantation, Riverine soil, Vegetable garden and Pond. The investigation was carried out for a period of Six month from first September 2015 to 29<sup>th</sup> February 2016. Sampling was conducted in ten selected ecosystems of Palakkad regions. The water holding capacity were measured by 50 gm soil was taken in a funnel whose base was covered by a filter paper. Funnel end was placed in a conical flask and the apparatus was held in position with a stand. 50 ml Distilled water was then added to the soil through the funnel and kept undisturbed for five minutes. This was repeated with all samples. The water collected after five minutes was taken and volume was determined. Then calculate the water holding capacity of soil. And also using pH meter for determine the soil pH. Collection of soil organisms from Monolith sample by using Hand picking method, Floatation method, Berlesse-Tullgren Funnel and Bearmann Funnel methods. Specimen identification was done by using identification keys, consulting taxonomic experts, past works and internet.

## OBSERVATION AND RESULTS

A total of ten ecosystems were selected from Palakkad district. The different types of ecosystems show various soil faunal diversity. In selected ecosystems, four ecosystems were monoculture plantation (Arecanut, Coconut, Banana plantation, Paddy), two ecosystems were mixed crop system and agroforestry (Rubber plantation :it consist Rubber, Banana, Coconut and Vegetable garden :consist of Chilly ,Brinjal ,Ladies finger and Garden pea), three naturally existing ecosystems (Riverine, Grass land and Pond ecosystem) and one is a heterogeneity ecosystem (House hold ecosystem).

**Rubber**, Soil in the rubber tract is generally highly weathered and consists mostly of lateritic type. Sedimentary types and non-lateritic type red and alluvial soils are also seen in some non-traditional areas. The soil is mostly very porous, well drained, moderately to highly acidic. Well drained soil is essential for optimum growth and yield of rubber plants. Annual rain fall ranges between 200-450 mm. Maximum temperatures about 29°C to 34°C. **Vegetables** basically a tropical crop, grows well in warm and humid climate of which grow best within a temperature range of 20-27°C. Ladies finger, Brinjal and Pea can be grown in a wide range of soils. However, they grow best in loose, mild acidic, well drained sandy loam soil rich in organic matter. Manures were used in the cultivation. The soil type of the area was sand clay loam with a brownish red colour. Both the ecosystems located in a naturally existing forest area Chulanor Peacock sanctuary, Alathur taluk and also it's a mixed crop system and agroforestry nature. Both ecosystems have a high species richness, a moderate species evenness throughout the whole samples. The mixed crop cultivation was helpful to soil fauna diversity and abundance.

**Banana**, basically a tropical crop, grows well in a temperature range of 15-35 °C with relative humidity of 75-85% up to an elevation of 200m. Four months of monsoon (June to September) with an average 650-750 mm rainfall are important

for vigorous vegetative growth of banana. The banana plantation selected belongs to the village of Attassery, Karimpuzhapanchayath, Ottappalam taluk. The soil texture of the area was of a mixed type of sandy loam which was loamier. **Paddy**, Rice is a tropical crop and grown where the average temperature during the growing season is between 20°C and 27°C. Abundant sunshine is essential during its four months of growth. The minimum temperature should not go below 15°C as germination cannot take place below that temperature. Paddy requires more water than any other crop. As a result, paddy cultivation is done only in those areas where minimum rainfall is 115cm Paddy also needs flooded conditions with the depth of water varying over 25 mm at the time of transplanting to as much as 150 mm for 10 weeks of the growing period. The selected area was located in Malampuzha, Palakkad taluk. Here, laterite and black clay soil were seen in common. The soil faunal diversity was relatively low, as it was main reason the water level and anthropogenic activity is very high. **Arecanut** are grown well in diverse soil type and they perform well in fertile clay loam soils or gravely laterite soils or red yellow podzolic type. This soil is mainly laterite, the texture of the soil varies from fine to coarse. The selected area was located in Karipode Thattamangalum village, Chittoor taluk. **Coconut**, is grown under different soil types such as loamy, laterite, coastal sandy, alluvial, clayey and reclaimed soils of marshy low lands. The ideal soil conditions of better growth and performance are proper drainage, good water holding capacity, absence of rocky or any hard substratum. The coconut palm selected belongs to Karipode, Tattamangalum village, Chittoor taluk. The soil was of the sandy clay loam type with brownish black in appearance.

**Pond** consists abiotic environmental factors and biotic communities of organisms. The selected pond ecosystem belongs to Govt. Victoria College Palakkad the soil collected has a sticky appearance of clumps which was black clay loam. **Riverine** they show wide variation in their physical-chemical properties depending obviously on the nature of alluvium that is deposited and the characteristics of the catchment area through which the river flows. Horizontal differentiation is not well expressed. They are very deep soil with surface texture ranging from sandy loam to clay loam. The sample soil was collected from Kannadi River belonging to Kannadipanchayath, Palakkad taluk. It is one of the main tributaries of Bharathapuzha River originating in the foothills of the Anamalai hills in the eastern fringes of Palakkad district of Kerala. The presence of organic matter helped to the flourished growth of soil fauna in this region. **Grass land** mainly consist of large grassy area. Grassland seasonal drought and fires are very important to biodiversity. The soil of the temperate grass land is deep and dark with fertile upper layer. It is nutrient rich from the growth and decay of deep, many branched grass roots. The rotted roots hold the soil together and provide a source for living plants. Each different species of grass grows best in particular grass land environment (determined by temperature, rain fall and soil conditions). The selected area is located in Sreekrishnapuram, Ottapalam taluk. The soil type was clay loam, brownish colour, the undisturbed area it help to the colony formation. so it help abundance of soil fauna.

**House hold** type of soil is hard and with soil clumps mainly as a result of regular human intervention. The soil type is loamy and dry in appearance without moisture content. The

selected household is located in Thuppanad, Karimbapanchayath, Mannarkade taluk. The faunal diversity was relatively low clearly showing the effect of regular human interventions. But it is heterogeneity ecosystem it contain different types of shrubs, herbs and some trees also so it mainly help to colonization of some organisms like Ants mainly.

From the collected data analyzed, the following were observed. The ants were collected from all land use systems and from all plots, but showed a non-uniform distribution. Annual crops have least ant diversity. Earthworm showed patchy distribution in different land use systems, though they are important components of the soil ecosystem and coined as ecosystem engineers. Their density and distribution was limited to certain habitats of the study area. Different fauna were identified from various soil types and their number also varied. In the habitat wise distribution of these groups, there was a gradual increase in the number of organism from intensively managed agriculture systems to less intensively managed agroforestry systems and natural ecosystems. A popular assumption is that anthropogenic interference results in the loss of biological diversity and the most frequently cited example is of agricultural intensification directly resulting in biodiversity reduction. The data also supports this hypothesis that land intensification has a negative impact on the soil fauna mainly in macrofauna. The highest organism richness and abundance was observed in land use system with minimum disturbance and mixed crops. Increased abundance of species community itself is an indication of ecosystem sustainability. The soil fauna in this study area was scanty and patchy. In summary, richness of ants, termites and earthworms as well as higher taxonomic groups of the entire soil macrofauna increased with increasing heterogeneity of the systems and decreasing disturbances. Soil quality and soil macrofauna responded negatively to land use intensification and changed positively in consensus with increasing habitat heterogeneity. The results support the growing body of literature that points towards the negative impact of native vegetation clearance, habitat loss and fragmentation on biodiversity. It also supports the hypothesis that anthropogenic disturbance has negative impacts on soil fauna.

The soil fauna present in different ecosystems belonging to three phylum like Annelida, Arthropoda and Mollusca. Phylum Arthropoda is most dominant soil faunal group. That particular group is well adapted to all environmental conditions (Fig 3). The comparative analyzing of soil faunal group in selected ecosystems 50% soil fauna belonging to Phylum Arthropoda, 33.33% of soil fauna belonging to Phylum Annelida and Phylum Mollusca having only 16.67% soil fauna were obtained in different selected ecosystems. It mean that the particular group Phylum Mollusca having lest adaptation capacity compared to other major groups. The main reason of least diversity of Phylum Mollusca need higher amount of water compared to other major groups like Arthropoda and Annelida. That group very much sensitive to environmental conditions and nature of ecosystem. (Table 1).The analyzing of water holding capacity and pH of soils from selected ecosystem. The water holding capacity highest in Paddy 33 ml. The pH range of Palakkad district soil range is normally 6.5-8.5 and the selected ecosystem soil also show the particular range 6.5-8 (Fig 1).

Comparison of key indicator like earthworms, ants and termites in selected ecosystems. Earthworm is a major key indicator of an ecosystem, is present in all ecosystems but the abundance of earthworm is vary from one ecosystem to another ecosystem. Ants and termites are absent in paddy ecosystem, the main reason is the agriculture practices. The key indicator are show the patchy distributions, the main reason is the nature of an ecosystems (Fig.2).A better picture on the soil fauna richness in different selected ecosystems could be perceived by comparing the numerical abundance of different organisms present belonging to different orders. The results have tabulated and presented (Table 2).The numerical abundance of soil fauna in each order within a different ecosystems showing discontinuous distribution. Total 23 orders under the different classes. The order Hymenoptera showing the highest numerical abundance, it mean that the particular group well adapted to all environmental conditions. In paddy field shows the very least soil faunal condition, because that area water level is high, compare to other ecosystems.so it mean that the water level is mainly depend on the soil faunal diversity. The presence of water due to agronomic practices.

#### \*Statistical analyzing of diversity index

$D = (N(N-1)) / (\sum n(n-1))$ . Species diversity index allows us to compare the species richness of different habitats. More individuals isn't always better, variety is important. The agroforestry tree based mixed crop ecosystem showing the higher diversity 225.the main reason is the nature of ecosystem id very much help to the diversity of soil fauna. Vegetable ecosystem share the almost same character of Rubber ecosystem the diversity index is also high 197.The clear evidence its prove that the Sorenson's coefficient similarity index is 0.971.Normally the anthropogenic factors negatively impact on the soil faunal diversity, but in the case of agroforestry mixed culture system, the average level of anthropogenic activities not very much highly influenced on the soil faunal diversity compared to other cultivations. The anthropogenic activities is present in that particular rubber and Vegetable ecosystem but in the agroforestry mixed culture system it help to minimize the anthropogenic negative impact and it help to maintain or enhance the soil faunal diversity of that particular ecosystems (Table 2).

According to **Sorenson's coefficient**, it help to compare the two different ecosystems soil faunal compositions. The Rubber is tree based agro ecosystem that ecosystem have the maximum species diversity so it taken as the typical ecosystem and also in the case of agroforestry heterogeneity ecosystem. So the similarity index between Rubber and vegetable have the maximum similarity, i.e. 0.971. The main reason vegetable ecosystem is also an agroforestry condition so the soil faunal diversity is very high. The lowest similarity index is noted in paddy field 0.090, the main reason the paddy field is a monoculture and the anthropogenic interference is very high. Based on Sorenson's coefficient similarity index Rubber ecosystem is taken as typical and its compared other ecosystem showing the similarity in the order of descending order the highest similarity is Vegetable (0.971) then followed to Banana (0.838),Coconut (0.812),Arecanut (0.812),Grassland (0.774),Pond (0.750),House hold (0.714),Riverine (0.583) and Paddy (0.090) (Table 3).

The species richness is high in polyculture agroforestry system but in the case of the species abundance is less compared to other natural ecosystems. The phylum Arthropoda is a largest and dominant group in the nature. Analyzing of Arthropoda groups, belonging to Arthropoda three classes were obtained under the each class several orders are present. Based on this data, it give the correct picturization of Arthropoda diversity. The absence of soil Arthropoda groups in paddy cultivation field because the main reason is high anthropogenic non sustainable agricultural practices. (Fig 3).

\* **Simpson's diversity index-** Simpson's dominance index (**D**) measure of diversity of soil fauna of different selected ecosystems.  $D = 1 - \frac{\sum n(n-1)}{N(N-1)}$  The highest diversity of soil fauna present in Rubber (0.906) then it followed by Banana (0.894),Vegetable (0.878), Coconut (0.878), Arecanut (0.872),Pond (0.870),Grassland (0.854), Riverine (0.796), Household (0.766), Paddy ( 0.731).The paddy field show the lowest diversity index. Simpson index is a dominance index, because it gives more weight to common or dominant species.in this case, a few rare species with only a few representative will not affect the diversity.

### III. DISCUSSION

The study were conducted among the different types of ecosystems, of the different regions of Palakkad district, it was found that major soil fauna consist of Phylum Arthropoda.

Ants were the important components of ecosystems, their biodiversity is incredibly high and these organisms are highly responsive to human impact, which obviously reduces its richness (Folgaralt 1998) .Ants occur throughout the world and constitute an important fraction of the animal biomass in terrestrial ecosystems (Holldobler et al.1990). Inthe current study, ant diversity was high compared to termites and earthworms. This heterogeneity in the vegetation would have contributed to the ant diversity by providing food and foraging habitats to different species.Studied the ant diversity across different disturbance regimesand their results support the present study, in that the highly disturbed area has less abundance, compared to moderately and less disturbed land use systems (Graham et al.2004). Of the four main ecosystems studied here (annual crops, plantation, agroforestry and natural ecosystem), annual cropping and plantation showed less abundance while agroforests and naturally existing ecosystems showed the high abundance.

Termites are the most important decomposers by virtue of their numerical dominance (Eggleton et al.1995). Disturbance affects termites by reducing their diversity (especially of soil-feeding forms) and some species may reach pest status, owing to changes in the availability of organic matter. There was a negative or inverse relation between earthworm and termite density in different land use systems (Decaens et al.1994). Abundance of termite was found varying between habitats and across land use systems and plots. It was reported that abundance and biomass showed strong dependence on the quantity of organic matter and nitrogen in the soil and in the current study land use systems with comparatively high organic matter, termite showed high abundance and diversity. This supports the previous findings that favourable soil conditions enhance soil fauna. It was also

reported that, above ground vegetation and habitat heterogeneity have positive effect on termite community (Gillison et al.2003). This can be used as a good strategy for ecosystem recovery and have great impact on soil fertility and ecosystem function.

Earthworm activity is very important in agricultural soils with a high degree of compaction and improving water infiltration offering new paths for root penetration. Termite's excavation activity has a similar effect on soils ( Gullan et al.1994),and in some cases can reduce the compaction of surface layers where organic matter is present in the soil, the bioturbations and decomposing activities of termites can reduce soil compaction, increase its porosity and improve its water infiltration and retention capabilities (Mando 1997).The lower diversity and abundance of soil fauna in the intensively managed annual cropping system could be due to poor heterogeneity and food resources.in the annual cropping systems, the land is utilized year around for growing crops compared to the agroforestry systems and natural ecosystems ( Giller et al.1997),show very close correlation between increasing agricultural intensification and reduced soil biodiversity. This intensification may also lead to soil erosion which in turn can reduce the abundance and diversity of soil biota by physically removing them destroying their microhabitats and changing the microclimatic conditions within soil (Harvey 1996).

Studies show that habitat destruction adversely affecting survival of major soil faunal components like earthworms, ants and termites. Habitat fragmentation, climate change, invasive animals, plants and anthropogenic activities are other important factors that threatens their survival (Woodman et al.2008).Maintaining and improving the capacity of soils to function is essential to human survival, and healthy soil is an essential element within this process (Pankhurst 1997). The ecological attributes of the soil are important since they have implications beyond the quality of the soil or its health, the capacity to produce a particular crop. They are associated with the soil biota, its diversity, its food-web structure, its activity and the range of functions it performs in the system. The soil biota is a vital force that serves to maintain the health of the soils. Larger organisms such as springtails, insect larvae, ants, termites, earthworms and ground beetles etc. Most are helpful to plants, enhancing the availability of nutrients and producing chemicals that stimulate plant growth. A healthy soil produces healthy crops with minimal amounts of external inputs and few to no adverse ecological effects. It has favourable biological, physical and chemical properties.

### IV. CONCLUSION

Analysis of the soil parameters such as pH and water holding capacity differ greatly proving that the ecosystems of Palakkad regions show a gradual variation in soil faunal diversity. The study was mainly focused on mesofaunal diversities. Major soil fauna under the three phylum like Annelida, Arthropoda and Mollusca. The survey of soil fauna the major group is Arthropoda and it consist 3 classes Arachnida, Insecta and Myriapoda. Belonging to each classes several orders were present under the class Arachnida five orders, Insecta and Myriapoda have 12 and 2 orders respectively. Under the Phylum Mollusca having one class Gastropoda, belonging this class two orders were present and under the Phylum Annelida have 2

Classes each class consist one order. In the current study, the dominant Orders are Hymenoptera, Coleoptera and Isoptera.

The count data on earthworms, ants, beetles and termites indicate spatial contagion in the density distribution of these taxa. This is also an indication of habitat heterogeneity which influences the distribution and abundance of macrofauna. The abundance and diversity of soil animals is often influenced by a wide range of management practices including tillage, treatment of crop residues, crop rotation, application of pesticides and fertilizers. In this study, taxonomic richness and abundance of meso and macrofauna was higher in the tree-based systems compared to the annual crops. This is probably because trees and shrubs in forest ecosystems and agroforestry systems provide more favourable microclimate to soil fauna. Trees bring about a whole complex of environmental changes, affecting light, air temperature, humidity, soil temperature, soil moisture content, wind movement, and pest and disease complexes. These changes have impacts both on plants and a wide array of soil macrofauna. The sampling covered different ranges of agricultural intensification—from intensive annual cropping systems to less managed, highly stratified polyculture and home garden agroforestry systems and the results indicate that there was increasing diversity and abundance of soil fauna from intensively managed annual cropping systems to less intensively managed agroforests and natural forest ecosystems. In conclusion, negative impact of native vegetation clearance, habitat loss and fragmentation on biodiversity. It also supports the hypothesis that anthropogenic disturbance has negative impacts on soil fauna.

Characterization of soil fauna diversity with shifting land use has great significance. Land use changes have great impact on biodiversity. Land use change is projected to have the largest global impact on biodiversity within 100 years (Sala et al. 2000). biodiversity in managed landscapes gain more attention of conservation value, because as much as 90 % of the biodiversity resource in the tropics are located in human dominated or working landscapes. Land use intensification witness extreme events like continuous utilization of same land for years, the permanent agriculture (Giller et al. 1997) at one end to low intensified agroforestry systems with multipurpose tree crops (MPT) at other end which have vital role in the tropical biodiversity conservation.

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**FIGURE CAPTION LIST**

1. Water holding capacity and pH range of various selected ecosystems
2. Relative numerical abundance of Earthworms, Ants and Termites in various selected ecosystems
3. Soil Arthropoda diversity of various ecosystems

**TABLE CAPTION LIST**

1. Major soil fauna of various ecosystems
2. Diversity of soil fauna in each ecosystems
3. Sorenson's coefficient similarity index of selected ecosystems

**Table 1: MAJOR SOIL FAUNA OF VARIOUS ECOSYSTEMS**

Sl. No	Phylum	Class	Order	Organisms	Ecosystem		
1	Annelida	Oligochaetae	Megadrilaceae	Earthworms	All ecosystems		
		Gnathobdellida	Hirudinida	Leech	PC, PE		
		Arachnida	Acarina	Mites	CP, AP, VP,RP,GL		
			Parasitiformes	Ticks	CP, AP		
			Thelyphonida	Whip scorpion	RP,BP		
			Scorpionidea	Scorpion	HH,VP,RP,CP,GL		
			Araneida	Spiders	PE, AP, VP,RP,BP,CP,GL,HH		
					Ephemeroptera	May flies	GL,PE,RE
					Isoptera	Termites	HH, RE, PE, BP, RP, VP,AP,CP,GL
					Hymenoptera	Ants	HH, RE, PE, GL, AP, BP, RP, VP,CP
					Coleoptera	Beetles (Adults & Larva )	HH, RE, PE, GL, CP, AP, BP, RP, VP
					Diptera	Flies (Adults & Larva )	RE, PE, RP,VP,AP,GL
					Dermaptera	Earwigs	PE, RP, VP,BP,AP,CP,GL,HH
					Orthoptera	Cricketes,Gryllotalpa	PE, RP,VP,BP,AP,CP,GL,RE,HH
					Notoptera	Grylloblata	VP,RP,BP,AP,CP,PE,RE
					Protura	Proturans	VP,RP,PE
Diplura	Diplurans	VP,RP					

2	Arthropoda	insecta	Collembola	Collembolans	VP,RP,BP,GL,PE
			Thysanura	Lepisma	RP,VP,BP,AP,CP,GL
		Myriapoda	Diplopoda	Millipedes	RP, VP,AP,CP,HH,BP
			Chilopoda	Centiped	CP,HH,AP, RP, VP,BP,PE
3	Mollusca	Gastropoda	Soleolifera	Slugs	PC
			Pulmonata	Snail	PC

VP - Vegetable Plantation

PC – Paddy cultivation

RP – Rubber Plantation

GL – Grass Land

BP – Banana Plantation

PE – Pond Ecosystem

AP – Arecanut Plantation

RE – Riverine ecosystem

CP – Coconut Plantation

HH - House Hold

**TABLE 2: DIVERSITY OF SOIL FAUNA IN EACH ECOSYSTEMS**

Order	SELECTED ECOSYSTEMS									
	Vegetable	Rubber	Banana	Arecanut	Coconut	Paddy	Grass land	Pond	Riverine	House hold
Megadrilacea	15	16	12	15	15	6	24	3	9	5
Hirudinidae	0	0	0	0	0	7	0	4	0	0
Acarinia	18	20	0	27	24	0	6	0	0	0
Parasitiformes	0	0	0	48	30	0	0	0	0	0
Thelyphonida	0	4	2	0	0	0	0	0	0	0
Scorpionidea	4	3	0	0	4	0	1	0	0	3
Araneida	11	6	9	6	4	0	2	12	0	9
Ephemeroptera	0	0	0	0	0	0	24	6	8	0
Isoptera	25	30	9	24	18	0	8	45	21	15
Hymenoptera	54	42	6	30	18	0	36	24	35	42
Coleoptera	15	26	9	15	12	0	7	24	6	4
Diptera	4	12	0	6	0	0	12	27	17	0

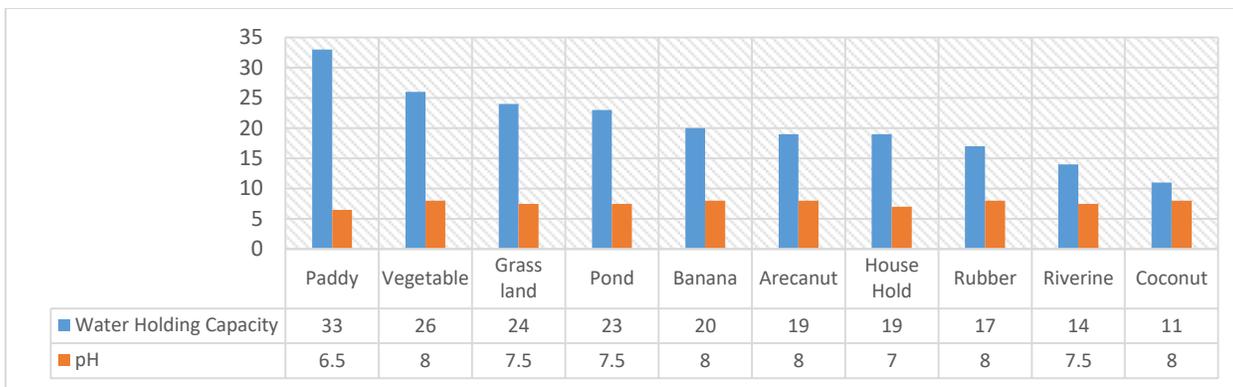
Dermaptera	4	6	4	10	4	0	6	13	0	3
Orthoptera	4	6	2	3	2	0	6	12	5	3
Notoptera	4	2	2	6	2	0	0	2	2	0
Protura	6	12	0	0	0	0	0	4	0	0
Diplura	9	4	0	0	0	0	0	0	0	0
Collembola	6	7	4	0	0	0	3	4	0	0
Thysanura	6	9	5	6	4	0	5	0	0	0
Diplopoda	9	12	1	4	5	0	0	0	0	12
Chilopoda	4	9	5	2	4	0	0	6	0	3
Soleolifera	0	0	0	0	0	12	0	0	0	0
Pulmonata	0	0	0	0	0	10	0	0	0	0
Diversity index	<b>197</b>	<b>225</b>	<b>69</b>	<b>201</b>	<b>145</b>	<b>34</b>	<b>139</b>	<b>187</b>	<b>102</b>	<b>98</b>
<b>D= <math>\frac{N(N-1)}{2}</math></b>										
<b><math>\sum n(n-1)</math></b>										

**Table 3: SORENSON'S COEFFICIENT SIMILARITY INDEX (S) OF SELECTED ECOSYSTEMS**

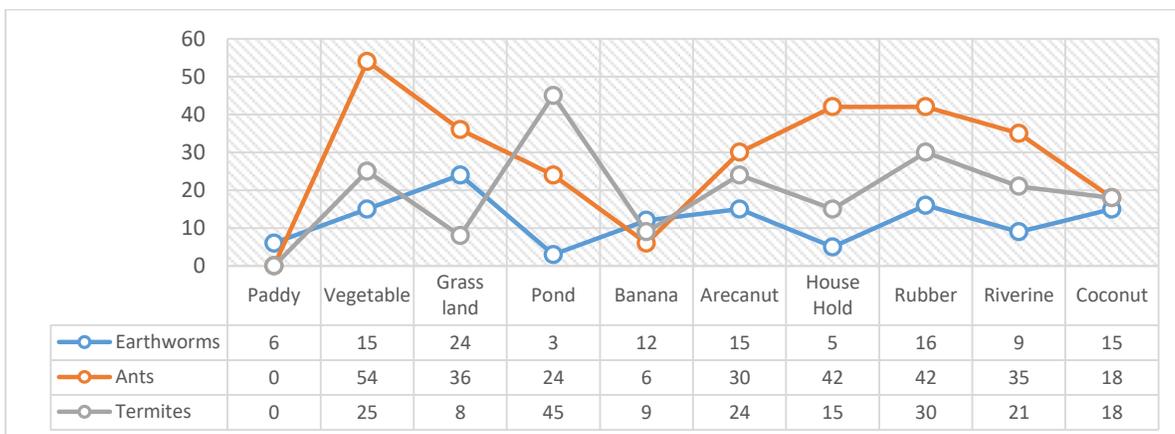
Similarity index(s)	Vegetable	Rubber	Banana	Arecanut	Coconut	Paddy	Grass land	Pond	Riverine	House hold
Vegetable	<b>1.000</b>	0.971	0.800	0.838	0.838	0.095	0.800	0.774	0.560	0.740
Rubber	0.971	<b>1.000</b>	0.838	0.812	0.812	0.090	0.774	0.750	0.583	0.714
Banana	0.800	0.838	<b>1.000</b>	0.814	0.814	0.117	0.692	0.740	0.571	0.782
Arecanut	0.838	0.812	0.814	<b>1.000</b>	0.928	0.111	0.740	0.714	0.636	0.750
Coconut	0.838	0.812	0.814	0.928	<b>1.000</b>	0.111	0.740	0.571	0.545	0.833
Paddy	0.095	0.090	0.117	0.111	0.111	<b>1.000</b>	0.117	0.222	0.166	0.142
Grass land	0.800	0.774	0.692	0.740	0.740	0.117	<b>1.000</b>	0.740	0.666	0.695
Pond	0.774	0.750	0.740	0.714	0.571	0.222	0.740	<b>1.000</b>	0.727	0.666

Riverine	0.560	0.583	0.571	0.636	0.545	0.166	0.666	0.727	<b>1.000</b>	0.555
House hold	0.740	0.714	0.782	0.750	0.833	0.142	0.695	0.666	0.555	<b>1.000</b>

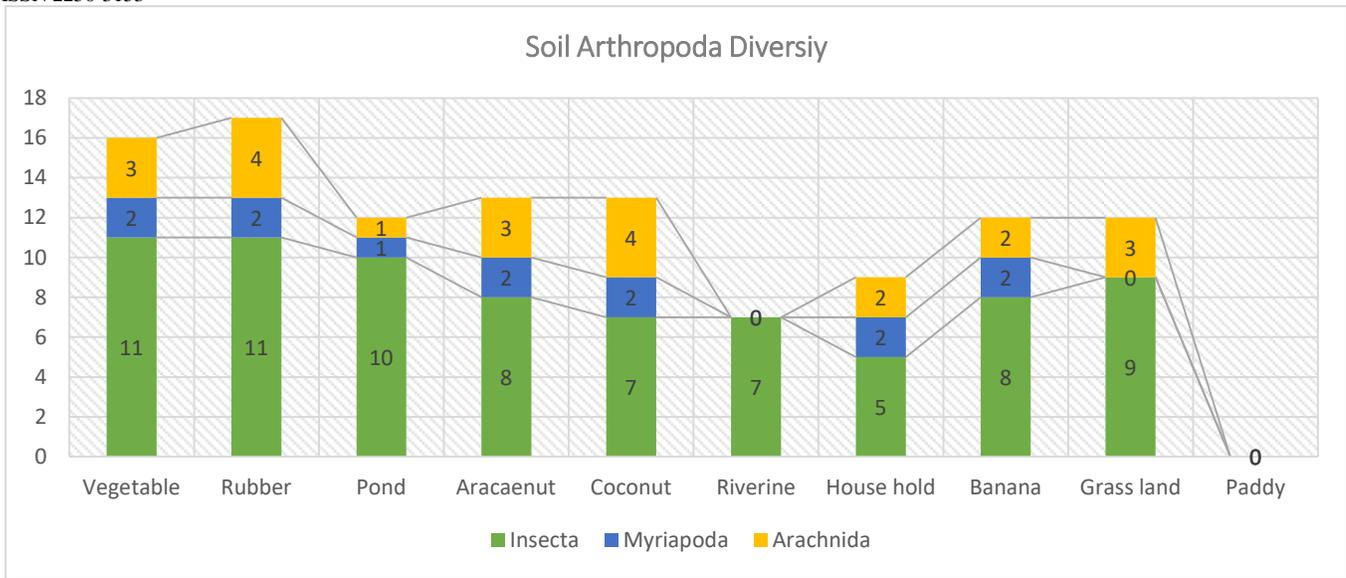
**Fig 1: WATER HOLDING CAPACITY AND pH RANGE OF VARIOUS SELECTED ECOSYSTEMS.**



**Fig 2: RELATIVE NUMERICAL ABUNDANCE OF EARTHWORMS, ANTS AND TERMITES IN VARIOUS SELECTED ECOSYSTEMS.**



**Fig. 3: THE SOIL ARTHROPODA DIVERSITY OF VARIOUS ECOSYSTEMS**



# SUPERVISED FEATURE SELECTION BASED EXTREME LEARNING MACHINE (SFS-ELM) CLASSIFIER FOR CYBER BULLYING DETECTION IN TWITTER

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**Abstract**— Cyber bullying detection that are prevailing commonly in social networks like Twitter is one of the focussed research area. Text mining and detecting cyber bullying has several research challenges and lot of research scope to work with. This research work makes use of supervised feature selection by ranking method in order to choose the features from the tweets. After that extreme learning machine (ELM) classifier is employed in order to perform the detection of cyber bullying tweets. Performance metrics such as accuracy and time taken for classification are chosen in order to evaluate the efficiency of the classifiers namely ELM and the proposed SFS-ELM. Implementations are done in MATLAB tool. From the obtained results it is evident that the proposed SFS-ELM produces better results than that of ELM

**Keywords**— *Cyber bullying, Twitter, feature selection, classification, detection, extreme learning machine, machine learning.*

## I. INTRODUCTION

Text mining is the field of data mining that has several varieties of text analytics. Text mining is the procedure of getting information / knowledge from text. There are lot of techniques used in performing text mining research. As far as the real time real time scenario is taken into account, many texts are in the form of semi – structured that tends to more scope of research in field of text data mining. Cyber bullying detection in twitter is of the interesting research area where it contains lot of research dimensions in text mining. Cyber criminals are making use of social network for doing several kinds of cybercrimes which includes phishing (Aggarwal et

al., 2012), spamming (Yardi et al., 2009), spread of malware (Yang et al., 2012), and cyberbullying (Weir et al., 2011).

Due to the raise of social networking sites and internet particularly cyber bullying became a major threat for the users (O’Keeffe & Clarke-Pearson, 2011). Salmivalli, 2010 came up with the definition stating that Cyberbullying is performed by making use of information and communication technology by a single person or as a cluster of users to indulge in bothering erstwhile user(s). In the literature Xu, Jun, Zhu, & Bellmore, 2012 mentioned that Cyber bullying is recognized as a severe country’s health issue that leads to victims disclose a noticeably elevated peril of with zilch to live for though provoking. Twitter is a widespread online social network facility that makes users to send and read 140-character messages. The Twitter network presently contains over 590 million users, of which 297 million users are fanatically barter a few words through this network and generate approximately 610 million tweets per day. Around 82% of these ardent users of twitter are sending their tweets through the help of their smart phones and tablets. Even supposing twitter turned into an imperative, near real-time communication channel (Kavanaugh et al., 2012), a study resolute that Twitter is turning into a “cyberbullying playground” (Xu et al., 2012).

Twitter changed its face into new targets for cybercrime, and wicked users try to carry out illegal activities such as cyber-attacks, bullying, fraudulent information, organized

crimes, and even terrorist attack planning on these systems (Yu et al., 2015). In addition Twitter is more prone to malwares, spam messages and other offensive materials (Akoglu et al., 2010; Gao et al., 2012; Hassanzadeh and Nayak, 2013; Rahman et al., 2012; Shrivastava et al., 2008). It is obvious that cyberbullying causes not only monetary loss and also affects a person's behaviour patterns. Such activities of the cyberbullies in Twitter necessitate the scope of cyber forensics in social networks arena. With all this kept in mind, this research work aim to propose supervised feature selection based extreme learning machine (SFS-ELM) classifier for cyber bullying

## II. RELATED WORKS

Mohammed Ali Al-garadi et al., presented a set of inimitable features; which includes network, activity, user, and tweet content plagiaristic from Twitter. A supervised engine wisdom procedure has been projected based on the feature for cyberbullying detection in the Twitter. The evaluation results of the authors work offered a practicable result for Cyberbullying detection that most commonly occurs in internet using scenario with help of their proposed detection model. The authors obtained data collected from Twitter during January 2015 and February 2015 and made use for their evaluation process. The collected twitter data almost consists of two and half million geo-tagged tweets that falls in the geographic region of California with the help of application programming interface service of Twitter. The authors categorised the features as system, action, client, and content, to spot cyberbullying behaviour, and used NB, SVM, random forest, and KNN for engine wisdom. All the four classifiers have been evaluated in four various settings, to be specific, essential classifiers, classifiers with highlight determination systems, classifiers with SMOTE alone and with highlight choice procedures, and classifiers with cost-touchy alone and with highlight choice strategies. AUC has been considered for the measure of performance. AUC has high robustness for evaluating classifiers. Accuracy, remind, and f-measure were also used as orientation methods.

Random forest using SMOTE alone proven the finest AUC (0.943) and f-measure (0.936).

R. Forssell investigated the occurrence of cyberbullying and face-to-face bullying in Swedish operational time and its family member towards gender and organisational spot. A large sample of 3371 respondents has been involved in the study. A cyberbullying behaviour questionnaire (CBQ) has been used in the study; 9.7% of the respondents have been categorized as cyberbullied in harmony with Leymann's cut-off criterion, 0.7% of the respondents as cyberbullied and 3.5% of the respondents as bullied confronting each other. Their study also revealed that men when compared with women were exposed to a high degree of Cyberbullying. People with a supervisory position were observed with additional exposure on cyberbullying than persons with no administrative duty.

Manuel Gámez-Guadix et al, examined the possibility of the nearness of an identifiable gathering of stable casualties of cyberbullying. The author analysed the solidity of cyber victimization linked through the perpetration of cyberbullying and bully-victim position. The psychosocial problems of non-stable fatalities and non-involved nobles have been compared with stable victims. The authors used a taster of 680 Spanish adolescents which includes 410 girls in completing the self-report method on cyberbullying perpetration and persecution, depressive symptom, and challenging alcohol employ at two time points that were split by one year. The cluster analyses grades suggested the existence of four distinct victimization profiles. Stable-Victims (5.8% of the sample) were observed with persecution at mutually Time 1 and Time 2. The authors also found that the steady fatalities were more expected to drop into the bully-victim class and accessible extra cyberbullying perpetration than the relax of the groups. Time1-Victims (14.5% of the sample) and Time 2-Victims (17.6% of the sample) offered persecution only at one time. Non-Victims (61.9% of the sample) offered least persecution at both times. Overall, the authors observed that the steady fatalities set with higher scores of depressive side effects and

hazardous use of alcohol more than time than the erstwhile groups, while, the Non-Victims with the lowest of the scores. Their result have been observed with main implications for deterrence and intrusion hard work intended at dropping cyberbullying and its penalty.

In the literature by Chen et al in 2012 proposed a mechanism in order to identify offensive language. The mechanism has been built up with a lexical syntactic feature and confirmed an elevated precision when compared with the conventional learning based mechanisms.

Dadvar et al., in the year 2013 conducted a study on the YouTube database. The authors made use of support vector machine in order to detect Cyberbullying. The authors stated in the literature that by making use of user-based content improved the detection accuracy of SVM. Using data sets from MySpace, Dadvar et al. built up a sexual orientation based cyberbullying location approach that utilized the sexual category include in upgrading the separation limit of a classifier. Dadvar et al. what's more, Ordelman et al. included age and sexual orientation as components in their approach; in any case, these elements were constrained to the data gave by clients in their online profiles. Besides, most reviews established that lone a couple of clients gave finish data about themselves in their online profiles. On the other hand, the tweet substance of these clients were broke down to decide their age and sexual category (D. Nguyen, Gravel, Trieschnigg, & Meder, 2013).

A few reviews on cyberbullying discovery used dishonor words as a component (Kontostathis, Reynolds, Garron, and Edwards, 2013), along these lines altogether enhancing the model execution. A current review (Squicciarini, Rajtmajer, Liu, and Griffin, 2015) proposed a model for distinguishing cyberbullies in MySpace and perceiving the pairwise communications between clients through which the impact of spooks could spread. Nalini and Sheela proposed an approach for distinguishing cyberbullying messages in Twitter by applying an element determination weighting plan (Nalini and

Sheela, 2015). Chavan and Shylaja included pronouns, skip-gram, TFeIDF, and N-grams as extra components in enhancing the general grouping exactness of their model (Chavan and Shylaja, 2015).

### III. PROPOSED WORK

#### III.1 Supervised Feature Selection using Ranking Method

As far as supervised approach is concerned, a class of tweets are obtained as the basic unit or context for computing connotation scores for language. Connotation compute fundamentally portrays how ordinary a fastidious words' incidence is in a set of tweets when judge to the previous sets of tweets. When there are unexpected words in the tweet are present at that point significance measure brings about high importance scores. In this portion it is analogous to the Multinomial Naive Bayes in which the all the tweets in a class is converged into a solitary tweet and afterward the probabilities are assessed from this one huge class tweets. In supervised meaning measure, parameter represents tweets that fit in to class and speaks to the total preparing set. It is assumed that a component shows up times in the dataset, and times in the tweets of class. The length of dataset (i.e. preparing set) and class measured by the aggregate term frequencies is and individually. is the rate of the length of the dataset and the class which figure in (3). In view of these the quantity of false cautions is characterized in(4)

$$L = \sum_{d \in S} \sum_{w \in d} tf_w \dots (1)$$

$$B = \sum_{d \in c_j} \sum_{w \in d} tf_w \dots (2)$$

$$N = \frac{L}{B} \dots (3)$$

$$NFA(w, c_j, S) = \binom{k}{m} \cdot \frac{1}{N^{m-1}} \dots (4)$$

The connotation attain of the phrase  $w$  in a set  $c_j$  is distinct as:

$$meaning(w, c_j) = -\frac{1}{m} \log NFA(w, c_j, S) \dots (5)$$

In enjoin to make simpler the calculation connotation formula can be rewrite as:

$$meaning(w, c_j) = -\frac{1}{m} \log \binom{k}{m} - [(m-1) \log N] \dots (6)$$

The well-built the connotation attain of a phrase  $w$  in a set  $C_j$  can be perceived as that the given word  $w$  is further meaningful, important or edifying for that class. It is firmly to mention that, the phrases with well-built connotation score be in contact to extra important, noteworthy or enlightening words for that particular set. On the other hand, for characteristic choice is required for an approach to consolidate these class-based scores into one and select top  $R$  features. In enjoin to do this ranking method is applied. Ranking perform sort the elements by utilizing their importance scores for each class. For instance, the rank of the main component on each sorted rundown will be 1 and the last component will be the word reference estimate. In this research work rank of the components is used in each class rather than their importance scores. When consolidating these class based records into a solitary component list, for each element the most noteworthy rank among all classes are picked as in (7).

$$score(w) = \max_{c_j \in C} (Rank(w, c_j)) \dots (7)$$

### III.2. Extreme Learning Machine Classifier

Once when the feature selection task is completed, ELM is employed for performing classification task. Given a set of  $N$  training samples  $(x_i, t_i)$  and  $2L$  concealed neurons altogether (that is, each of the two shrouded layer has  $L$  shrouded neurons) with the initiation work  $g(x)$ . At first arbitrarily introduce the association weight matrix between the info layer and the first shrouded layer  $W$  and the inclination matrix of the first concealed layer  $B$ , and afterward figure the weight matrix  $\beta$  between the second concealed layer and the yield layer.

$$g(W_H H + B_1) = H_1 \dots (8)$$

where  $W_H$  indicates the weight matrix between the first shrouded layer and the second concealed layer. It is assumed that the first and second concealed layers have a similar number of neurons, and subsequently  $W_H$  is a square matrix. The documentation  $H$  indicates the yield between the first concealed layer as for all  $N$  preparing tests. The matrices  $B_1$  and  $H_1$  individually speak to the inclination and the normal yield of the second shrouded layer.

The normal yield of the second shrouded layer can be ascertained as

$$H_1 = T\beta^+ \dots (9)$$

where  $\beta^+$  is the MP widespread contrary of the matrix  $\beta$ . The manipulative means of  $\beta^+$  is the alike as before discussed for  $H^\dagger$ , namely  $\beta^+ = (\beta^T \beta)^{-1} \beta^T$  if  $\beta^T \beta$  is non-singular, or alternatively  $\beta^+ = \beta^T (\beta^T \beta)^{-1}$  if  $\beta \beta^T$  is non-singular. Consequently it is defined the augmented matrix  $W_{HE} = [B_1 \ W_H]$ , and calculate it as

$$W_{HE} = g^{-1}(H_1) H_E^\dagger \dots (10)$$

where  $H_E^\dagger$  is the widespread contrary of  $H_E = [1 \ H]^T$ ,  $1$  denotes a one-column vector of size  $N$  whose components are the scalar unit 1, where the notation  $g(x)$  denotes the contrary of the calculation of  $H^\dagger$  proceeds in the fashion described some time recently. The investigations directed to test the execution of the ELM calculation. In order to perform the classification task extensively used logistic sigmoid function  $g(x) = 1/(1 + e^{-x})$  is used. The real yield of the second shrouded layer is calculated as

$$H_2 = g(W_{HE} H_E) \dots (11)$$

and finally, the mass matrix  $\beta_{new}$  flanked by the second shrouded layer and the real layer is calculated as

$$\beta_{new} = H_2^\dagger T \dots (12)$$

where  $H_2^\dagger$  is the MP widespread contrary of  $H_2$ , gotten utilizing the approach talked about some time recently. The ELM yield in the wake of preparing can be communicated as

$$f(x) = H_2 \beta_{new} \dots (13)$$

**Algorithm 1.** ELM Algorithm

Input: N training samples  $X = [x_1, x_2, \dots, x_N]^T$ ,  $T = [t_1, t_2, \dots, t_N]^T$  and 2L hidden neurons in total with activation function  $g(x)$

1: Haphazardly create the association weight matrix between the information layer and the first shrouded layer W and the inclination matrix of the first concealed layer B and for straightforwardness,  $W_{IE}$  is defined as [ B W] and likewise,

$X_E$  is defined as  $[1 X]^T$ .

2: Calculate  $H = g(W_{IE} X_E)$  :

3: Acquire weight matrix between the second shrouded layer and the yield layer  $\beta = H^\dagger T$

4: Compute the normal yield of the second concealed layer  $H_1 = T \beta^\dagger$

5: Decide the parameters of the second shrouded layer (association weight matrix between the first and second concealed layer and the predisposition of the second shrouded layer)  $W_{HE} = g^{-1}(H_1) H_E^\dagger$

6: Acquire the real yield of the second concealed layer  $H_2 = g(W_{HE} H_E)$

7: Recalculate the weight matrix between the second shrouded layer and the yield layer  $\beta_{new} = H_2^\dagger T$

**Output:** The final output of ELM is

$$f(x) = \{ [W_H g(W X + B) + B_1] \} \beta_{new}$$

**IV. RESULTS AND DISCUSSIONS**

Performance metrics such as classification accuracy and time taken for classification are chosen for comparison. 4556 tweets from various topics such as demonetisation, kids, mobilephones, sachin and whatsapp words are searched in Twitter and analysed as positive opinion tweets and negative opinion tweets. The analyzed tweets are presented in Table 1. Implementation are carried out using MATLAB 2012.

**A. Figures and Tables**

Table 1. Collected Tweets with various search terms and opinion analysis

File Name	Total No. of Tweets	Actual	
		Positive Opinion Tweets	Negative Opinion Tweets
demonetisation.txt	1003	498	505
kids.txt	984	402	582
mobilephones.txt	783	599	184
sachin.txt	994	483	511
whatsapp.txt	792	599	193

- True Positive (TP) → Correctly identified as positive opinion tweets
- False Positive (FP) → Incorrectly identified as positive opinion tweets
- True Negative (TN) → Correctly identified as negative opinion tweets
- False Negative (FN) → Incorrectly identified as negative opinion tweets

$$Accuracy = \frac{(TP + TN)}{(TP + TN + FP + FN)} * 100$$

Table 2. Performance Analysis of the Classifiers

Performance of the existing ELM classifier
--------------------------------------------

File Name	TP	TN	FP	FN	Accuracy (%)	Execution Time (seconds)
demonetisation.txt	413	398	101	91	80.86	192
kids.txt	335	461	91	97	80.89	183
mobilephones.txt	467	159	79	78	79.95	177
sachin.txt	394	417	82	101	81.59	199
whatsapp.txt	443	191	97	61	80.05	169
Performance of the proposed SFS-ELM classifier						
File Name	TP	TN	FP	FN	Accuracy (%)	Execution Time (seconds)
demonetisation.txt	461	474	41	27	93.22	147
kids.txt	409	514	33	28	93.80	139
mobilephones.txt	562	168	14	39	93.23	128
sachin.txt	447	479	36	32	93.16	132
whatsapp.txt	579	162	31	20	93.56	133

Table 2 portrays the performance analysis of the proposed SFS-ELM and existing ELM classifiers. It can be observed that the overall accuracy of the SFS-ELM classifier is improved by 13%. The implementation of the proposed SFS-ELM and existing ELM classifiers are implemented using MATLAB. The performance analysis in terms of accuracy is shown in Fig.1 It is to be noted that the execution time of the proposed SFS-ELM classifier is comparatively lesser than that of the existing ELM classifier. The performance analysis in terms of execution time is shown in Fig.2.

Fig. 1. MATLAB Result Graph for Performance Analysis of the Classifiers in terms of Accuracy (in percentage)

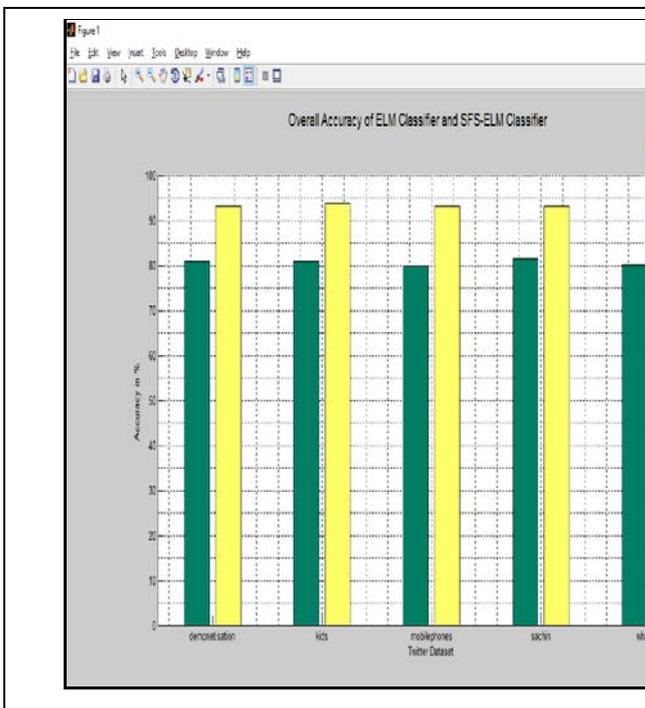
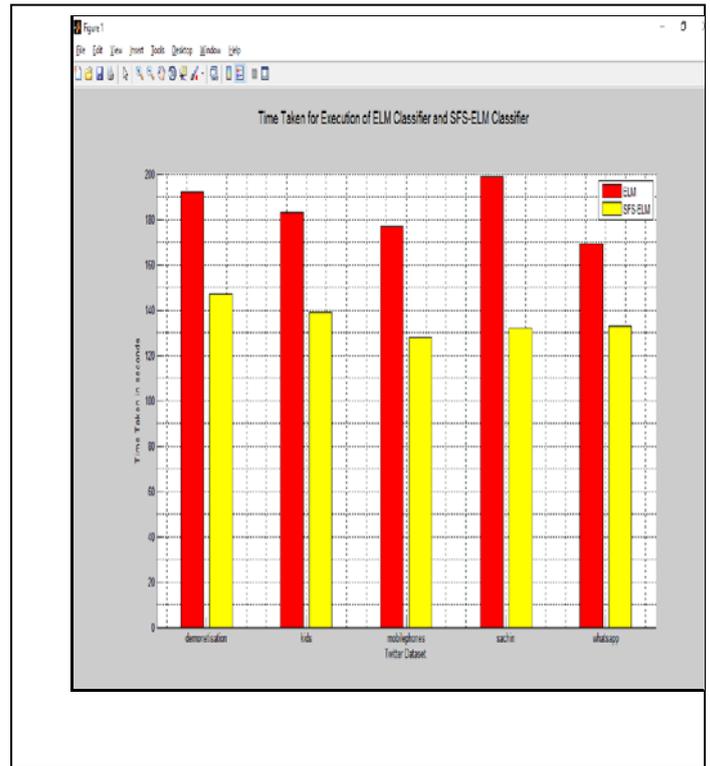


Figure Fig.2. MATLAB Result Graph for Performance Analysis of the Classifiers in terms of Execution time (in seconds)



## V. CONCLUSIONS AND FUTURE WORKS

This research work proposes design and development of supervised feature selection based extreme learning machine (SFS-ELM) classifier for cyber bullying detection in twitter that aims to improve the detection accuracy and reduce the execution time. Supervised feature selection is carried out by making use of ranking strategy. Extreme learning machine classifier is employed for carrying out detection. Five datasets are collected from Twitter namely demonetisation, kids, mobile phones, sachin and whatsapp and 1003, 984, 783, 994, 792 tweets are collected respectively. SFS-ELM classifier is implemented in MATLAB and the results poses better accuracy with reduced execution time.

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# Trippler Tourism Management System Using Data Mining

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**Abstract-** Annually a large number of tourists are arriving to Sri Lanka from different places in the world, to visit so many places in Sri Lanka. Therefore the tourism industry is becoming a great portion of national economy and it opens vast number of occupations for the Sri Lankan community throughout the various tourism companies. So the tourism companies should be more effective and enrich with enough facilities to keep all the customers which coming for them and serve the customers as they expect. But still the tourism industry couldn't overcome this challenge due to the many tourism companies have not a real understanding about who are the most frequent customers? From where, when and how they come, what are their preferences and expectations? If the tourism companies could gather this information, they could be manage and utilize their services and resources in a very efficient and effective way in order to serve all the customers perfectly. So this research is focusing to developing a web based solution to find out most frequent and potential customers who arrive to the tourism companies and important details about them. The data mining techniques will be applied to find out this information using the data which collected from tourism companies. And discovered knowledge will be presented in graphs and send this information Tourism Company management. So this information is more valuable to change their businesses into effective ways.

**Index Terms-** Sri Lankan Tourism industry; Web application; tourism business strategy; data mining; graphical data representations; find frequent customers; proper business navigation; Time series algorithm

## I. INTRODUCTION

Data mining is commonly termed for a set of techniques that help to analyze and recognize significant facts, relationships, trends, patterns, exceptions and anomalies that might otherwise go unnoticed that exists in large amounts of data. Although Data Mining (Data Mining) is still in its infancy, many developed countries have successfully applied Data Mining tools and techniques in different domains and have gaining useful knowledge from historical data. Data Mining incorporates a multitude of techniques from a variety of fields including databases, statistics, data visualization, machine learning and others. Large amounts of data are collected, stored and analyzed to obtain knowledge which is sometimes crucial in decision making. Data mining have been successfully applied in various domains such as Business, Finance, Biology, Medicine, Text Mining, Web Mining, Marketing and Financial Forecasting [1].

Sri Lanka is one of the most popular tourist destinations in the region. But the tourists which coming for hotels and other tourism companies, are not properly served and thrilled customers as they expected. Incapability to manage resources and services in effective and efficiently way is the main reason for this. Sometimes the resources will be inefficient for tourists such as rooms, foods etc. Servants in the hotel may be not enough to serve all the tourist properly. So those are reasoning to reduce the quality of services and it will be highly affect for the business profit. Unexpected customer arrivals is root for this problem. If those companies could find about most frequent and potential customers and important details about them (when and how they come, their economy level, their interesting places, rooms basis, taxies and room packages), the business could be customize into an attractive and interesting way for those tourists. This research is focusing to discover the most frequent and potential customers and important details about them. Those data will be graphically represented and alert relevant details hotel wise using the web application.

In order to conduct a Data Mining experiment, the project team recommend considering the following questions to provide a direction to the experiment with less guesswork.

### **Identify what types of knowledge useful for tourism industry**

This was a very initial step of this research. This question means what are the most important and valuable information in the tourism companies as well as tourist in the Sri Lanka. What were the most important knowledge which useful for making the desersions in tourism companies.

### **Identify what data to select for the experiment**

The discovered result should be more accurate, because the business plans and management decisions are highly affected by those results. In order to increase the accuracy of discovered knowledge, the data set should be large. Large number of tourists are arriving to tourism agencies. So these data in past years (at least one or more) are most relent to this project.

### **Find How to predict most important tends which useful for tourism industry**

After determined what are predicted and collected data to predict this question arise. The knowledge which discovered should be accurate and effective for the tourism industry in the Sri Lanka. So a proper methodology was needed for this project.

## II. BACKGROUND

There are many researches done in the field of data mining.

An article which reviewed is discussing the advantages of using network data in forecasting demand for China travel. Mapping information organization and network of relationships to build demand in the tourism sector between the author, and describes the use of methods of data mining Web, analyzes and forecasting of tourism demand, Based on the principle of building knowledge and explanations web data mining process Analysis and forecasting. In the case of the use of Shanghai as a city to do an empirical analysis Points. [2]

The aim of this study is to find a time, travelers are looking for guests from the travel search behavior. This study focuses on the use of mobile devices as a destination recognized travel options, such as visitor accommodation, tourist attractions, travel services, restaurant and gift shop tools. They use data mining and association rules technology approach to analyze the relationship between information and transactions between the travelers. Knowledge found in the database can be used as a set of rules that provides flight information via mobile travelers. Our system is designed as a complementary educational knowledge. The results show that: the use of data from the intelligent analysis of the tourism sector can increase the chances of a competitive tourism company to effectively respond to the needs of travelers. [3]

Japan has become an important tourist destination. Arrivals of tourists has increased significantly in the last decade. According to the 2000 Japan accounted for passengers to travel JNTO is 4,757,146, a total of 2012 the number of Japanese visitors to 8,358,105, and in 2013 and 24% in the same period last year, As a result of our analysis, They found that the satisfaction of the two different groups, the most important factor is the price of the ticket, and Japanese cuisine, shopping, how many visits Japan ions past experience. In addition, satisfaction and non-Asian groups in Asia, two different groups, different preferences and purpose of the visit. The behavioral intentions favorite experience some aspects, such as the future of Japan's hot springs are used to return the incentives. The tourists mainly travel with your family and the ticket price is an important factor. [4]

Every day, millions of people around the world travel business, Vacation, travel, or other reasons. Astronomical Money spent on tickets, accommodation, food intake, Transportation and entertainment. According to the World TourismBureau, tourism is about Global gross domestic product (GDP), 11 percent (of GDP) (Werthner and Ritchie, 2004). Tourism is based on information Service, wherein there are two types of traffic. One the flow of information from the provider to the consumer or tourists. This is about the goods Tourist information Consumption, such as tickets, hotel rooms, entertainment and so on. Go ahead. Another flow of information, which should be the opposite Line consists of a summary of relevant visitors Service providers. In this chapter, they will discuss the second Tourist information in the form of flow behavior. When gathering data about your visitors presented in the right direction, by using the correct algorithm, and provide analysis in the right hand, it can be translated into Italian Tourist information services produced important decisions Vendors increase revenue and profits. Data

mining can Analysis of data related to travel a very useful tool. [5]

In recent years, tourism has become one of the fastest growing sectors of the global economy, it is idly regional and national economic development was recognized contribution. Travel Product Design and development of the region's growing number of foreign sources / countries have become important activities and household income. On the other hand, it is a strong contender for customer relationship management Companies need to integrate their customers and need to stay focused on strategy the organization customer-centric approach. Therefore, They use Appropriate algorithm One for data mining association rules and clustering analysis method, which is due to the implementation of Case Firm, Phoenix International Travel customer knowledge to dig in Taiwan. Know how Knowledge extraction from data mining results mode, rules and knowledge described in the map In order to make the new product development and customer case for the company to provide advice and solutions Relationship management. [6]

High competitive pressure in the global manufacturing industry makes efficient, effective and continuously improved manufacturing processes a critical success factor. And Indication-based Manufacturing Optimization as a novel data mining-driven approach for process optimization provided by the Advanced Manufacturing Analytics Platform. And this research paper defines conceptual use cases and described implementation details, Indication-based Manufacturing Optimization goes beyond existing analytics in manufacturing, which focus on manual reporting and OLAP functions using isolated data extracts and it discussed pre-defined data mining use cases are applied to identify hidden data patterns for the optimization of the whole manufacturing process, from the creation of the production order until the finishing of the product [7]

Another article reviews the application's data Mining Processing travel papers Industry, whether it is from both demand and supply of the web. Especially important in the field of tourism science, SCOPUS Published in the journal in 1995 – 2013 Search and use proper keywords. Literature search and found 88 papers presentation Tourism data mining applications. Keywords and The concept of network analysis conducted Sixth device using Wordle and Lanet. Paper from Tourism-related magazines and journals were related to ICT Separate analysis. In order to explore the historical trend, These two periods were analyzed Conclusions 2005 and since 2006, Paper is a step in the way of the development of tourism, as Two people driven and data-driven, and therefore need to use As a method to improve the use of data mining Competitiveness and profitability. [8]

An article detailed Indication-based Manufacturing Optimization as a novel data mining-driven approach for process optimization provided by the Advanced Manufacturing Analytics Platform. Defined conceptual use cases and described implementation details. [9]

The System, which use to have a more efficient plan for future year by analyzing past data. The proposed system is uses Data Mining technology to analyze the data. In the literature review, the team has discussed and searched about the existing deployed systems in the hotel management systems around the world and related solutions and researches have been done and developed by using data mining also the literature review has

covered about the data mining technology and how to apply them and how has applied.

### III. METHODOLOGY

Data mining denotes a rather difficult and specific field. A complicated and fixed approach is necessary for the use of data mining in order to help organizations use the data mining. For this project, Prototypes are expected and there will be very critical risk assessment when going through the project because the team does not have much experience within the domain. The spiral model emphasizes risk analysis. Remove all potential risks through careful analysis and, if necessary, by constructing a prototype before data is being mined several steps have to follow

**Data integration:** First collected and integrated all the data from different sources

**Data selection:** Then selected the data that can be used for data mining

**Data cleaning:** Most of the time, data gathered are not clean and may contain errors, missing values, noisy or inconsistent data. So, they have to remove. This process was done manually

**Data transform:** This step is done for get more efficient results and to gain results in understandable manner. Mainly normalization was done for the data

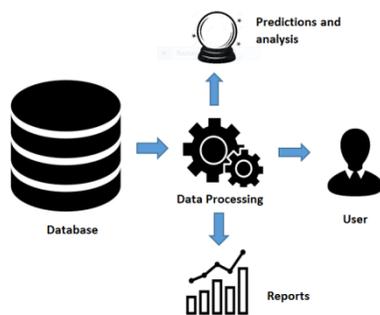
**Data mining:** In this step the algorithms were used for mine the database. The prediction was done by using Time Serious algorithm

**Pattern Evaluation and Knowledge Presentation:** First some of the results that are not related were removed fine tune other results well to understand by the users of the system.

Using Time Serious algorithm can forecast most tourist attracted hotels, destinations, room types and board basis

Which useful for management decisions in tourism companies. The predicted results were representing in web application in bar charts. Any user can view those predicted results using this web application. The results are getting through a mining model in Microsoft Business Intelligence using DMX queries.

**Figure 1: High Level**



### PREDICTIONS AND ANALYSIS

### IV. DESIGN OF THE SYSTEM

This chapter describes the expected results and actual outcome for each test case of testing each module. Some of the expected results of our system shown below one by one descriptively.



**Figure 2.1: Home Page**

This is the home page. This is the startup page of the web site and from this page; user can be navigated to the appropriate page which contains the prediction reports (hotel prediction, destination prediction, room class prediction, board basis prediction). Further navigated user can be to the pages which can view more details about the web application (using about us button) and contact details (using telephone receiver symbol).



**Figure 2.2: Hotel Prediction**

This page displays the report which contains details of hotel predictions. The bar chart at the left side of the page is demonstrating the top 10 hotels against the population in next twelve months. The x-axis represents the hotel name and the y-axis represents the population (number of tourist which can be come in to the hotel). And all the hotels will be listed according to the ranks. The rank will be considered according to the population.



Figure 2.3: Destination Prediction

This page displays the report which contains the destination prediction details. The bar chart at the left side of the page is demonstrating the top 10 destination s against the population in next twelve months. The x-axis of the bar chat is representing the destination name and the y-axis representing the population (number of tourist which can be come in to the destination). And all the destinations will be listed according to the ranks at the right side of the page. The destination rank will be considered according to the population.



Figure 2.4: Room Class Prediction

This page displays the report which contains the room class prediction details. The bar chart at the left side of the page is demonstrating the top 10 room classes against the population. The x-axis of the bar chat is representing the room class and the y-axis representing the population (number of tourist which can be using the room class). And all the room classes will be listed according to the ranks at the right side of the page. The room class rank will be considered according to the population.



Figure 2.5: Board Basis Prediction

This page displays the report which contains the board basis prediction details. The bar chart at the left side of the page is demonstrating the top 10 board basset against the population. The x-axis of the bar chat is representing the board basis and the y-axis representing the population (number of tourist which can be use the board basis). And all the board basset will be listed according to the ranks at the right side of the page. The board basis rank will be considered according to the population.

## V. DISCUSSION

The “Tripper Web Application” gives the accurate and important knowledge for the tourism companies in Sri Lanka. Final product is controlled by web application. Project team used latest technologies to the system when developing the project. This system predicts most tourist attracted places, hotels, room types and board basis for the next five months.

When developing this project team members felt with some difficulties. First one is clear the data. Data was collected from verity of sources and team had to form these data to one format which acceptable for the prediction algorithm. Another problem was the software incompatibility. The data mining tool and the web server was not connecting properly. So team members had to deep study about MSSQL and xamppweb server connection to overcome this problem. The Tripper Web Application is demonstrate the mostly tourist attracted hotels, destinations, room types and board basis in bar charts using predicted results in the mining models. Further user can see the results in next five months. In every bar charts the y-axis is demonstrate the tourist’s population. So the population can be conceded as the tourist attraction.

The bar chart is not demonstrating all the predicted results. It demonstrates only top ten results. So the ranking list shows the all predicted results in a descending order according to the tourist’s population. So user can check the tourist attraction level of a given factor (destination, hotel, room type, board basis) When user wants to see the results in a particular month, there is a dropdown list to select the month. When the month was selected the update the bar chart according to the new results of selected month. For this task the team had to implement this web application using Ajax technologies.

## VI. CONCLUSION

Tripper Web Application is a very useful and effective application in tourism industry in Sri Lanka. The predicted results by this Tripper Web Application are very important and valuable for the tourism companies as well as tourist which hopes to travel in Sri Lanka.

When the management is taking decisions in tourism companies, the predicted results of the Tripper Web Application will be very useful. So this web app can be considered as a decision support system also. When a tourist wants to travel in to Sri Lanka he/she can the most attracted places, hotels, room types and board basis in upcoming months. So those results will be very important for panning the trips to the Sri Lanka for the tourists also.

When a student wanted to get an idea about currently most tourists attracted thing in the Sri Lanka, this web application will be very useful. The government also can be use this web application to make their future planes to develop the tourism industry in the Sri Lanka. So when consider above thing the Tripper Web Application is a very important and effective system in the tourism industry in the Sri Lanka

As a main limitation in Tripper Web Application is the Tripper gives predictions only for Sri Lanka. So this application is valid for only the Sri Lankan Tourism industry. The another limitation is this application gives the predictions about next five months only. User can't get results more than five months. User can get predations for monthly wise and user cannot get predictions for a particular date. So this also a limitation of this web application.

The user can predicts only most popular places, hotels, room type and board basis only. User cannot get predictions about other factors in the tourism industry such as most popular transport method, food, drinks etc. Tripper Web Application is update mining models monthly wise only. So that also can be consider as a limitation of this system.

## VII. FURTHER WORK

The Tripper Web Application is currently predicts only the several tends in the tourism industry (mostly tourists attracted hotels, places, room type and board basis). But this application can be expand to predict more thing in tourism industry such as mostly tourists attracted fool items, transport methods, drinks etc. Currently this application get prediction for the next five months only. So this web application can be more developed to predict results more than next five months. Currently Tripper gives predictions for months only, so it also can be expanded to get prediction for an upcoming particular date.

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# PERFORMANCE EVALUATION OF TEF GRAIN AND CHAFF SEPARATION AND CLEANING MACHINE

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**Abstract:** The performance of the machine was evaluated in terms of separation and cleaning efficiencies, and separation and cleaning losses at different feed rate, sieves oscillations and sieves inclinations; three levels of sieve slopes (0, 5 and 10 degrees), four levels of sieve oscillation (5, 10, 15 and 20 Hz) and four levels of feed rates (3, 6, 9 and 12 kg/min) were used. The experimental design was factorial in split-split plot. The prototype tef grain separating and cleaning machine had the ability to winnow the premature grains, chaff and leaves, which are lighter than grains. It was also capable of reducing time wastage, grains loss, labour requirement and contamination. The performance evaluated in terms of separating efficiency, cleaning efficiency, separation loss and cleaning loss at different sieve slopes, sieve oscillations and feed rates indicate that the separation and cleaning losses increased with increasing sieve oscillation and feed rate for all sieve slopes. But the separation and cleaning efficiencies decreased with increasing sieve oscillations and feed rates at all sieve slopes. The minimum losses and the maximum efficiency were achieved at 5o sieve slope for all sieve oscillations and feed rates. The separation efficiency, cleaning efficiency, separation loss and cleaning loss were 97.94, 98.58, 0.71 and 0.7%, respectively at sieve oscillation of 5 Hz, feed rate of 3 kg/min and sieve slope of 5 degrees. The separation efficiency, cleaning efficiency, separation loss and cleaning loss were 52.71, 39.88, 25.62 and 34.5%, respectively, at sieve oscillation of 20 Hz, at feed rate 12 kg/min and at sieve slope of 5 degree.

**Key words:** Tef separation and cleaning, sieve slope, Sieve oscillation, feed rate, efficiencies, and losses.

## Nomenclature

FR-feed rate	SO – Sieve oscillation
Hz - Hertz	SS – Sieve slope
Kg – kilogram	
Min – minute	
MOG – materials other than grain	

## 1. Introduction

One of the economical cereal crops in Ethiopia is tef. It is indigenous to the country, and is a fundamental part of the culture, tradition, and food security of the people (Abayineh and Abebe, 2015). Currently, tef is grown on approximately 2.80 million hectares of land which is 27% of the land area under cereal production. Tef accounts for about a quarter of the total cereal production and is highly economical food grain in Ethiopia (Bekabil *et al.*, 2011). The traditional methods of postharvest handling of tef usually lead into contamination of the product with stones, sticks, chaff, dirt and dust. Therefore tef grain, after threshing cannot be stored or used for consumption or as planting material due to the very fact that the presence of long straws, chaff, small fragments of spikes, leaves, dust, dirt and other foreign materials in the grain will accelerate deterioration, thus lead to poor physical condition. Tef winnowing, separation and cleaning i.e. removal of undesirable materials, is accomplished manually by tossing the grain into air and letting the wind do the separation and cleaning, removal of lightest impurities, leaves

and large amount of debris with certain amount of grains. For further cleaning is usually done using sieves to remove the heavy particles and dirt larger than that of tef grain. Against all the odds, the Ethiopian farmers prefer to grow tef because it tolerance to low moisture stress, waterlogged and anoxic conditions being better than maize, wheat, and sorghum. Cattle prefer to feed on tef straw rather than any other cereal straws. Moreover, tef as grain has highest market prices than the other cereals; this includes both grain and straw, and the grain is not attacked by weevils during storage (Seyfu, 1993).

## 2. Material and method

This work was carried out in 2015 season, in order to study some parameters affecting separating and cleaning unit such as diameter of holes, air speed, sieve tilt angle, and sieve oscillation.

### 2.1. Machine specifications and description:

In the investigation, the machine used for tef chaff and grain separating and cleaning, was constructed and tested. The machine followed the design of (Abayineh and Abebe, 2015). The portable seed cleaner was developed to fill the need for a faster and more efficient method of tef grain and chaff separating and cleaning.

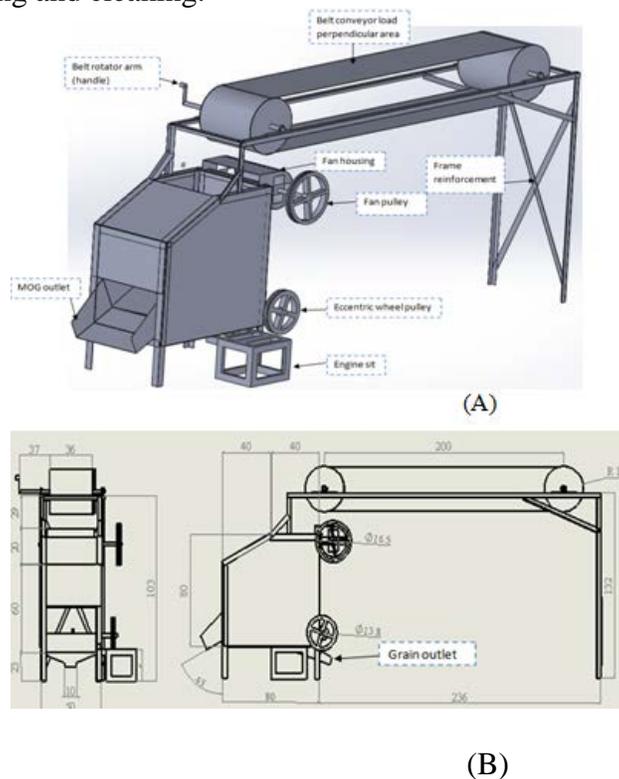


Figure 1. Details of the Experimental Tef Chaff Separating and Grain Cleaning Machine (A = isometric view, B = section view; all dimensions are in cm)

The machine is easy to operate and convenient to service and maintain. The machine consists of a frame, a belt conveyor, an oscillating triple-screen assembly, a centrifugal blower and diesel engine as shown in fig. 1.

General specifications of machine are: overall length 316cm, overall width 50 cm, overall height 148 cm, power of 5hp, easy operation; minimum adjustments, reduced repairs and maintenance problems. Multi crop capability, includes three screens with interchangeable accordingly. Simple design includes integral shaft for horizontal oscillating screen drive and fan.

## 2.2. Parameters measured

Separation and cleaning process take place along the sieve length as grain and MOG (material other than grain) were transported over the sieve. During each test run materials leaving through MOG outlet and those leaving through grain outlet were weighted using digital balance in order to determine the separation efficiency, cleaning efficiency, separation loss and cleaning loss.

The performance evaluation of the separating and cleaning machine was made on the basis of the following parameters; separating efficiency, cleaning efficiency, grain loss and cleaning loss. As per Amer (2009) separation efficiency and grain losses were calculated using Eq. (1 and 2).

$$SE = \frac{M_1}{M_2} \times 100\% \quad (1)$$

$$SL = \frac{M_4 - M_3}{M_4} \times 100\% \quad (2)$$

Where:  $M_1$  = the mass of impurities after separation and cleaning (kg),  $M_2$  = the mass of impurities before separation and cleaning (kg),  $M_3$  = the mass of grains after separation and cleaning (kg),  $M_4$  = the mass of grains before separation and cleaning (kg), SE = separation efficiency (%) and SL = separation loss (%)

The cleaning efficiency and cleaning loss were calculated using the equations given by Werby (2010); Eq. (3 and 4).

$$CE = \frac{M_{css}}{M_{sbc}} \times 100\% - CL \quad (3)$$

Where:  $M_{css}$  = mass of clean grain sample (the mass of grains after separation and cleaning) (kg),  $M_{sbc}$  = mass of sample before cleaning (kg) and CL is cleaning loss (%);

$$CL = \frac{S_l}{S_o} \times 100\% \quad (4)$$

Where: CL = cleaning loss,  $S_1$  = grain lost behind machine ( $M_4 - M_3$ ) in kg,  $S_o$  = grain output ( $M_3$ ) in kg.

### 2.3. Experimental Design and Treatment

To evaluate the separating and cleaning performance of the prototype machine, three levels of sieve slopes (0, 5 and 10°), four levels of sieve oscillation (5, 10, 15 and 20 Hz) and four levels of feed rates (3, 6, 9 and 12 kg/min) were used. The experimental design was factorial in split-split plot, 3 x 4 x 4 having 48 experimental units. Each combination of an experiment (slope x oscillation x feed rate) was replicated three times the total numbers of test runs were 144. The sieve slope was taken as main plot while sieve oscillation and feed rate were take as sub-plot and as sub-sub plot, respectively. The air velocity at fan outlet throughout the experiment was kept constant at 3.2 m/s which were considered to be equivalent to the minimum terminal velocity of tef grains.

### 2.4. Statistical Analysis

Data were subjected to analysis of variance following a procedure appropriate to the design of the experiment as recommended by Gomez and Gomez (1984). Analysis was made using Gen Stat 15<sup>th</sup> edition statistical software. The treatment means that were different at 5% and 1% levels of significance were separated using LSDT.

## 3. Result and Discussion

The air velocity over the sieve unit was kept close to the terminal velocity of tef grain. Oscillations of the sieves were made by using a four-bar linkage mechanism where the legs of the sieve holding frame were pinned and oscillated about a vertical plane.

### 3.1. Effect of sieve slope on separation efficiency and separation loss

As can be seen from Figure 3 (a) increase in sieve slope from 0 to 5 degrees increased separation efficiency from 64.72 to 73.37%; further increase in sieve slope, to 10 degrees, resulted in decreasing separation efficiency to 61.39%. This was due to the very fact that the grains moved out of the separation unit with the MOG because the greater force ( $mg\sin\alpha$ ) acting on the entire material, grain and chaff, down the slope and the difference between gravity component and inertia component of forces ( $mg\cos\alpha < m\omega^2r$ ) that lead to sliding rather than tossing and flailing the grain and chaff (Figure 2). This implies that at 10° sieve slope, the sieve tended to convey the grain and straw mixture before being sieved and sifting thoroughly. Consequently, grains went out with chaff through MOG outlet. The separation loss decreased from 12.95 to 10.20% as sieve slope increase from zero to 5 degree. Nonetheless, the separation loss increased to 18.08% as

sieve slope increased from 5 to 10 degrees (Fig.

3(a).

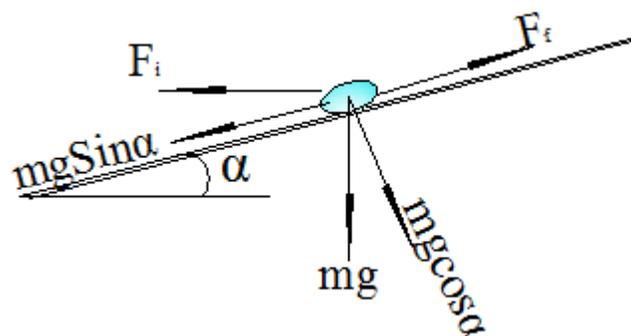


Figure 1. Forces acting on materials and their direction over the sieve surface ( $F_i$ =inertia force and  $F_f$  =friction force)

### 3.2.Effect of sieve oscillation on separation efficiency and separation loss

Separation efficiency tended to decrease with increasing sieve oscillation while separation loss increased with increasing sieve oscillation (Figure 3(b)). The increase in the separation loss was from 4.93 to 22.64 % as sieve oscillation increased from 5 to 20 Hz. The decrease in separation efficiency and increase of separation loss with increasing sieve oscillations may be due to less resident time of materials to be separated on the sieve. Higher sieve oscillations, forced grains and chaff to bounce without adequate time to reside on the sieve so that the separation and cleaning to take place, hence poor or low level separation became eminent leading into low separation efficiency and high separation loss. Voicu *et al*, (2011), concluded that high oscillation frequency lead, in general, to faster movement of grains on the sieve, hence less time was available for the grains to pass through materials on the sieve and sieve holes. They also indicated that at high sieve oscillation, grains and chaff be discharged without passing through the sieves perforations. Furthermore, it was learnt that sieves at high oscillation frequency could serve as conveyor rather than a means to sieve and sift through to effect separation.

### 3.3.Effect of feed rate on separation efficiency and separation loss

Figure 3(c) indicates that separation efficiency decreased with increasing feed rate while the separation loss increased with increasing feed rate. Increasing feeding rate from 6 to 12 kg/min decreased the separation efficiency from 72.69 to 55.98% while separation loss increased from 10.6 to 20.66% and effect was highly significant at ( $P < 1\%$ ) (Table 1). The low separation efficiency and the high separation loss with the increasing feed rate could be due to the thick layer of material (matting of grains and chaff) formed on the sieves that constrained penetration of grain through the mat of materials on the sieves. Hence, effect of the feeding rate could be seen as increasing of the thickness of mixture of grain and chaff layer on sieve. Above all, at higher feed rate, it takes a long duration of time for the grain to be separated from the MOG due to the denseness of the MOG that made diffusion of the grain through the MOG sluggish.

### 3.4.Combined Effect Sieve Slope, Sieve Oscillation and Feed Rate on Separation Efficiency and Separation Loss

Analysis of variance made in Table 1 indicates that the effect of sieve slope, sieve oscillation and feed rate were highly significant ( $P<0.01$ ) on both separation efficiency and separation loss.

Table 1. Analysis of variance of the result of the performance of the machine

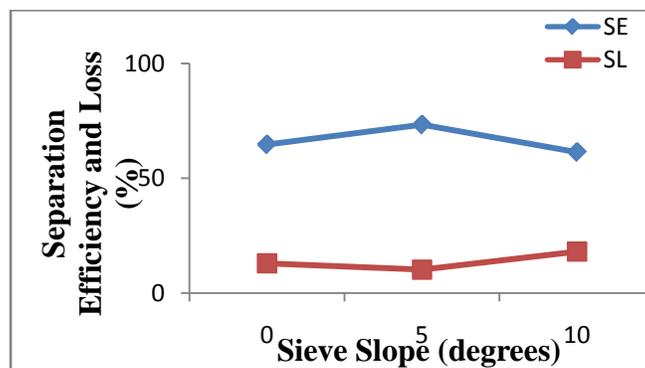
Source of variation	D.F	F-value			
		Separation Efficiency	Separation Loss	Cleaning Efficiency	Cleaning Loss
Replication	2				
SS	2	1684.4**	220.76**	179.4**	156.14**
SO	3	26058.02**	450.03**	433.42**	407.98**
FR	3	1960.44**	260.47**	217.73**	189.98**
SS x SO	6	2076.2**	19.49**	20.86**	21.27**

SS x FR	6	41.69**	2.55*	3.25*	3.73*
SO x FR	9	33.43**	7.52**	9.36**	10.5**
SS x SO x FR	18	39.14**	3.7**	3.19**	2.92**
Error	72				

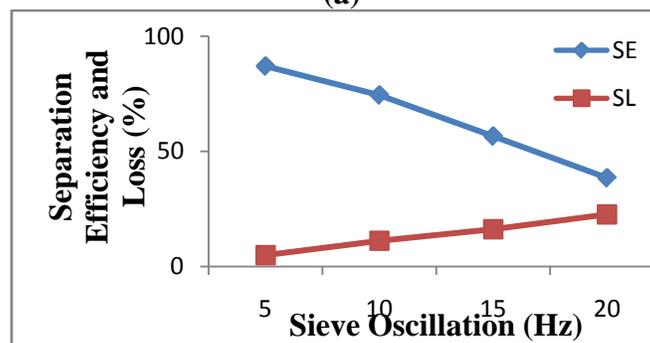
\*, \*\*; significant at 5% and 1% probability level, respectively; D.F degree of freedom

Sieve slope and sieve oscillation (SS x SO), sieve slope and feed rate (SS x FR) and sieve oscillation and feed rate (SO x FR) combinations had highly significant ( $P < 0.01$ ) effect on both separation efficiency and separation loss except that SS x FR combination had significant effect at  $P < 0.05$  on separation loss. Separation efficiency and separation loss were dominantly affected by sieve slope and sieve oscillation and followed by sieve slope and feed rate and sieve oscillation and feed rate. The high separation efficiency and low separation loss were obtained at 3 kg/min feed rate,  $5^\circ$  sieve slope and 5 Hz of sieve oscillation.

The combined effect of sieve slope, sieve oscillation and feed rate (SS x SO x FR) was also highly significant ( $p < 0.01$ ) on separation efficiency and separation loss. In generally, separation efficiency decreased with increasing sieve oscillation and feed rate while separation loss was increased with increasing feed rate and sieve oscillation.



(a)



(b)

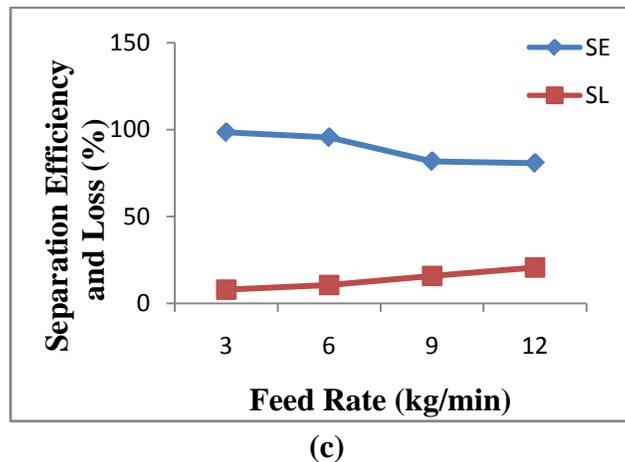
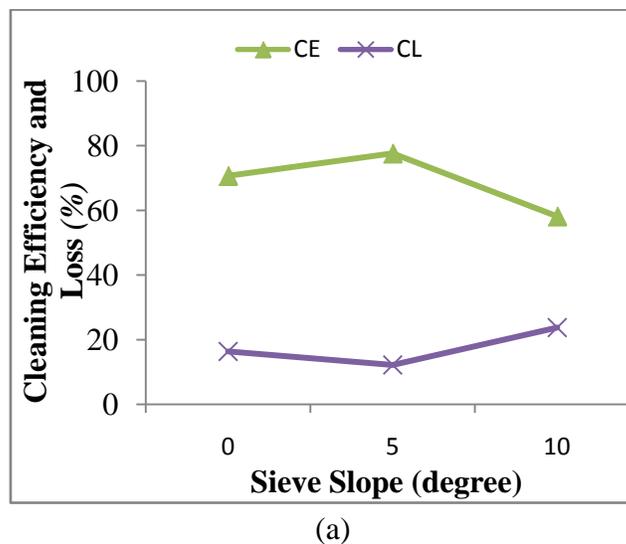
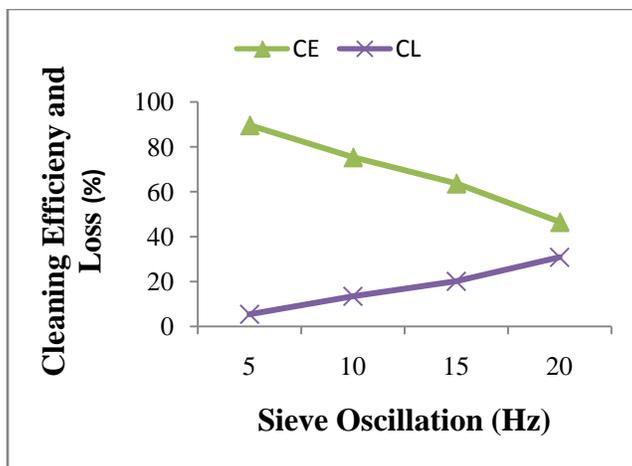


Figure 3. Effect of sieve slope, sieve oscillation and feed rate on separation efficiency and separation loss.

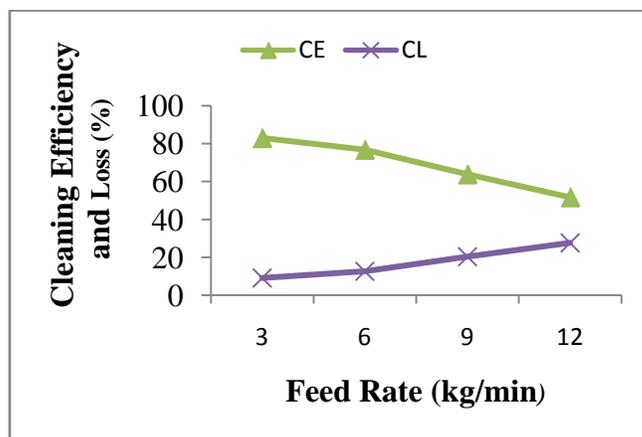
### 3.5. Effect of Sieve slope on Cleaning Efficiency and Cleaning Loss

As shown in Figure 4(a) increasing the sieve slope from 0 to 5 degrees lead to slightly increase cleaning efficiency and decreased cleaning loss. Increasing this slope to 10 degrees resulted in declining cleaning efficiency and increasing of cleaning loss. The phenomenon was common to all levels of sieve oscillations and feed rates and at sieve slope of 10 degrees grains were lost with chaff through MOG outlet.





(b)



(c)

Figure 4. The Effect of Sieve slope, Sieve oscillation and Feed rate on Cleaning Efficiency and Cleaning Loss.

### 3.6. Effect of Sieve oscillation on cleaning efficiency and cleaning loss

Increase in sieve oscillation, in general, lead to decreased cleaning efficiency and increased cleaning loss at different sieve slopes as shown in Figure 4(b). The mean values of the cleaning efficiency was decreased from 89.65 to 46.55% and cleaning loss was increased from 5.41 to 30.81% as sieve oscillation increase from 5 to 20 Hz, respectively. This was due to the fact that at higher sieve oscillations some grains and chaff could be forced to leave the cleaning unit with the chaff because of high inertia force acting on them, hence going through the sieve perforations would not be possible and the situation becomes worst when sieve slope increased.

### 3.7. Effect of feed rate on cleaning efficiency and cleaning loss

Figure 4(c) shows the relationship between cleaning efficiency, cleaning loss and feed rate. The declining cleaning efficiency and increasing cleaning loss with increasing rate of feeding was

due to the formation of a thick layer of material on sieves that considerably hindered or limited passage of grains through the sieve perforations. The increasing in cleaning loss and decreasing of cleaning efficiency with increasing feed rate could be attributed the load intensity on the sieve that could result in matting of the sieve with material other than grain blocking sieve holes. Furthermore, whenever there are high feed rate, the current supplied will not be capable of suspending and blowing the materials aerodynamically as multiple particles act as obstruction to airflow. For aerodynamic separation to occur, the particles in a mixture must be accelerated as free dispersed bodies and not as a mat, hence feed rate must be limited to 6 kg/min if the prototype machine has to be used.

### 3.8. Combined Effect of Sieve slope, Sieve oscillation and Feed rate on Cleaning Efficiency and Cleaning Loss

The calculated values and figures plotted clearly indicated that the cleaning efficiency decreased with increasing sieve oscillation and feed rate while the cleaning loss was increasing with increasing sieve oscillation and feed rate (Figures 4). Analysis of variance presented in Table 1 indicates that the effect of sieve slope, sieve oscillation and feed rate were highly significant ( $P < 0.01$ ) on both cleaning efficiency and cleaning loss. The combined effect of sieve slope and sieve oscillation (SS x SO), oscillation and feed rate (SO x FR) were highly significant ( $P < 0.01$ ) on both cleaning efficiency and cleaning loss. The combined effect of sieve slope and feed rate (SS x FR) was significant ( $P < 0.05$ ) on cleaning efficiency and cleaning loss. The second-order interactions between sieve slope, sieve oscillation and feed rate (SS x SO x FR) was highly significant ( $P < 0.01$ ) on both cleaning efficiency and cleaning loss. Table 10 presents the effect of the interaction between sieve slopes, sieve oscillation and feed rate at LSD 5%.

### 3.9. The Multiple Regression Analysis

The multiple regression analysis made the level correlation coefficients were used to identify parameters that had a dominant effect on separation and cleaning efficiencies and associated losses. From the equation given in Table 2 one can note that the dominant effect of feed rate except on separation efficiency.

Table 2. Multiple regression equation of parameters studied.

Regression	Equation	R <sup>2</sup>
SE Vs SS, SO and FR	SE = 128.044 -0.52xSS -3.21xSO -2.593xFR	0.834
SL Vs SS, SO and FR	SL = -14.231 +0.513xSS +1.163xSO +1.45xFR	0.824
CE Vs SS, SO and FR	CE = 137.008 -1.251xSS -2.82xSO -3.558xFR	0.802
CL Vs SS, SO and FR	CL = -22.78 +0.738xSS +1.657xSO +2.108xFR	0.783

### 3.10. Conclusion

Performance evaluation to quantify the effects of the sieve slopes, sieve oscillations and feed rates on separation and cleaning efficiencies and associated losses when separating chaff and cleaning tef grains and chaff was made. Three levels of sieve slopes, four levels of sieve oscillations and four levels of feed rates were investigated to identify the optimum combination of the variables in question. Based on the performance evaluation made and results obtained, the following conclusions can be drawn:

- The performance of the machine was significantly affected by feed rate, sieve oscillation and sieve slope in that order of dominance;
- Separation and cleaning efficiencies in general decreased with the increasing sieve oscillation and feed rate, while separation and cleaning losses increased with the increasing sieve oscillation and feed rate;
- The separation efficiency slightly increase as sieve slope increase from 0 to 5 degrees but further increase of sieve slopes up to 10 degrees kept on reducing the efficiencies of separation and cleaning;
- The separation and cleaning losses were decreased as sieve slope increased from 0 to 5 degrees and increased as sieve slope increased to 10 degrees;
- High levels of feed rate and sieve oscillation is considered are inefficient and cannot obtain satisfactory or acceptable efficiencies and losses;
- The study clearly indicated the optimum combination of sieve slope, sieve oscillation and feed rate to be 5 degree, 5 Hz and 3 kg/min, respectively for the prototype machine developed; and
- The multiple regression analyses made and the equations developed can be used as corner stones and spring boards to select optimum combination of the variable parameters to further develop and/or improve seeds and grains separating and cleaning machine.

### **3.11. Recommendation**

Based on the findings obtained, the following recommendations are made:

- Since the belt conveyor was operated manually, the uniformity of feed materials into the cleaning unit was not consistent; hence an automatic feeding must be developed and used;
- Oscillations on the sieves were developed using a four-bar linkage mechanism that make the displacement of the stacked sieves different, the efficiencies and losses might have be affected by the variation in the displacements of sieves; hence, slider crank mechanism be considered as an appropriate option for equal displacement of stacked sieves;

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# IOT Based Smart Public Transport System

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**Abstract-** Internet of Things (IoT) joins the objects of this present reality to the virtual world, and empowers at whatever time, anyplace network for anything that has a turn ON and turn OFF switch. It constitutes to a world where physical things and humans and other living things, and virtual information and situations, collaborate with each other. Substantial measure of information is created as expansive number of gadgets is associated with the web. So this expansive measure of information must be controlled and changed over to helpful data keeping in mind the end goal to create productive frameworks. In this paper, we concentrate on to a urban IoT framework that is utilized to construct Intelligent Transportation System (ITS). IoT based intelligent transportation systems are intended to bolster the Smart City vision, which intends to utilize the progressed and capable communication systems for the organization of the city and the residents.

**Index Terms-** IoT, ITS, NFC, WSN.

## I. INTRODUCTION

As the Wireless Sensor Networks have scientifically advanced more rapidly and more proficiently, they have become the key source for the advancement of IoT. They find use in almost all fields including smart grid, smart transportation systems, smart home, smart hospitals, and so on. The accomplishment of the above lead to the smart city development as mentioned by our Indian Prime Minister.

### a. Background

The idea of Internet of Things (IoT) was prepared in parallel to WSNs. The expression internet of things was conceived by Kevin Ashton and indicated the distinctively distinguishable things and their computer-generated demonstrations in an "internet-like" arrangement. These items may vary from vast constructions, aircrafts, automobiles, engines, any sort of produces, productions, to humans, animals and plants and even their specific body parts. One of the significant developments of WSNs will be after they are incorporated with IoT.

This paper intends to build up an intelligent transportation system. The future streets will have the capacity to oversee traffic blockage much superior to today's systems. It has been envisioned that in a time of around 20 to 30 years the current traffic system would enhance to a degree where automobiles can interact with each other with no human collaboration to control the traffic. Therefore travel could be made less exhausting and more secure. Sensors would be fitted in automobiles and these automobiles will be set on the streets. These would observe the

traffic and send the data remotely to a "central traffic control system," a center point that processes information to resend the data back to vehicles out and about. For example if there's huge traffic jam, the central traffic control system would be told over WiFi and they return respond by enforcing speed restrains that the vehicles must abide by in the region where the jam has occurred. Since a huge number of cash is spent on road traffic jams each year, it has been approximated that, by the realization of smart transportation systems, the cash spent will get decreased by no less than 15%. Extra advantages incorporate parking direction. As opposed to driving around the entire vicinity searching for space, the drivers would be guided over the WiFi regarding the empty spaces accessible close to their current position. Likewise, the drivers would be shown the shortest possible road to reach the desired place so that carbon dioxide emissions can be controlled. This framework could even caution the drivers about any school that is nearby where there might be bunches of students on the road and the optional course would likewise be recommended. In this innovation the telecoms join with WiFi consequently creating better results for the clients and also the buyers both at their jobs and also other places. The paper is organized as follows. Section II describes about the act of spontaneities that has been done to the common transportation framework. Section III clarifies the results and analysis of the current system and how proficient the proposed framework will be and the outcomes are thought about. Segment IV clarifies the disadvantages of the systems and the future upgrades that can be made to this framework. A Smart Assistance for Public Transport System is to be developed. The Public transport chosen is Public Bus. The issues related with government transport are examined and thought about. The issues, for example, bus arrival time expectation [2], no. of people accessible to the bus [2], accident reporting and safety, alcohol detection for driver [3], bus answer to travellers through on the web/non internet alternatives are accessible [4]. In the fundamental technique utilized is GPS/GSM is used. The PIR sensors are to be utilized at front and back entryway of the bus for individual counting in/out from the bus. Additionally, MQ3 alcohol detection sensor is utilized to measure liquor level of the driver and if alcohol is identified then transport won't begin and a message will be given to PMT through GSM network asking for replacement of driver. At that point an accelerometer is utilized to sense accidents and at the same time message is sent to PMT, specified hospital and enlisted police headquarters with the intention that they can give appropriate help to the passengers at the instance of mishap. At the point when the switch is been pressed, a message will be sent to enlisted police headquarters containing the information about transport and the area where the accident has occurred. The accompanying fig. represents the basic idea for the system.

## Motivation

The inspiration for this project was to limit and curtail the difficulties and issues related with public transport framework in India. India is a developing country with tremendous populace. Here, we confront numerous issues in our day by day life, for example, water, power, logistics, economy. In this way, to overcome no less than one of these issues as a civilian of our nation I have chosen to contribute my side to provide safe and intelligent Public Transport System for urban communities.

As we experience day to day issues with our public transport, my commitment is to limit the issues identified with it. The fundamental issues is of seat utilization i.e. no. of people or seats accessible in the bus. At the same time bus arrival and leaving time and real-time bus position information on Google map is additionally presented. The transport has elements of handicap ramp in order to give specially able individuals to make use of the bus effortlessly.

## II. LITERATURE SURVEY

In past works given in SeokJuLee[1], they have actualize transport vehicle tracking for UCSI University, kuala Lumpur, Malaysia. It is developed for settled course, giving the candidates with status of bus after determined time period utilizing LED panel smart phone application. Technique used is Arduino microcontroller Atmega328 based Arduino UNOR3 microcontroller. Additionally, for GPS, GSM/GPRS module a similar controller is used. Program to control them is composed in C programming language, compiled and saved in microcontroller's flash memory. The testing results in this paper give; testing in-vehicle module, testing web server and database, testing smart phone app.

In PengfeiZhou[2], foreseeing transport entry time with cell phones is given. Innovation utilized is participatory detecting of users. This model framework with various sorts of Android based cell phones and thoroughly explore different avenues regarding the NTU grounds carry transports and in addition Singapore transports over a 7-week time span, then taken after by London in 4-weeks. The proposed framework is arrangement is all the more for the most part accessible and is vitality agreeable. The assessment comes about recommend that the proposed framework accomplishes extraordinary expectation exactness contrasted and those operator initiated and GPS based solutions. The model framework predicts transport entry time with average tolerance of 80 sec.

In MamanAbdurohman[3], versatile tracking framework is utilized to monitor vehicles position and in uncommon cases there are much helpful data can be studied, for example, speed, cabin temperature and no. of passenger. This monitoring procedure is done utilizing GPS module, and sending the information to a server through GSM modem. It is proposed machine-to-machine (M2M) communication from which Open Machine Type Communication (Open MTC) as correspondence platform for collecting and preparing area information. The area is shown on Google outline. The Open MTC platform that is produced by Fraunhofer FOKUS in view of ETSI M2M Rel.1 specification.

In Minoru Sakairi[4], security measures to anticipate drunk and sluggish driver is specified. A framework is created called Water-Cluster-Detecting (WCD) for this reason. A expired gas contains water clusters that have a soaked vapour pressure of 47 mmHg and temperature of around 37C. This idea is utilized here for WCD, it identifies breath by measuring electric currents of positively or negatively charged water content in breath that are isolated by utilizing an electric field. WCD breath sensor is couples the WCD breath sensor with an alcohol sensor and it reproduces and identifies electrical signals of both breath and liquor in the breath. It recognizes breath from around 50 cm and can likewise test the level of readiness of a subject sitting in the driver's seat. It's tested by utilizing individual's expansiveness, not by a simulated source.

InMashoodMukhtar[10], The vehicle tracking system exhibited in this paper can be utilized for situating and exploring the vehicle with a precision of 10 m. The situating is done as latitude and longitude alongside the correct area of the place, by making utilization of Google maps. The system tracks the area of a specific vehicle on the client's demand and reacts to the client by means of SMS. The got SMS contains longitude and latitude that is utilized to find the vehicle on the Google maps. The vehicle tracking system enables a client to: remotely switch ON the vehicle's ignition system, remotely switch OFF the vehicle's ignition system, remotely bolt the entryways of the vehicle, remotely open the entryways of the vehicle, and remotely track a vehicle's area. A few changes were rolled out in which most striking improvement was modification of the tracking technique (i.e. Access to 32 channels of satellites rather than 3). The vehicle tracking system was manufactured effectively. In any case, the vehicle tracking system could be made more strong by utilizing more exact GPS unit.

In Mr. Prafull D. Patinge[11], This framework therefore diminishes the vehicle idle time as its being checked by officers by central authorities. The ideally planned courses can likewise benefit in better fuel utilization. This framework can likewise incorporated with various advances for extra elements and because of utilization of prevalent and broadly utilized technologies at affordable value makes it perfect for urban zones.

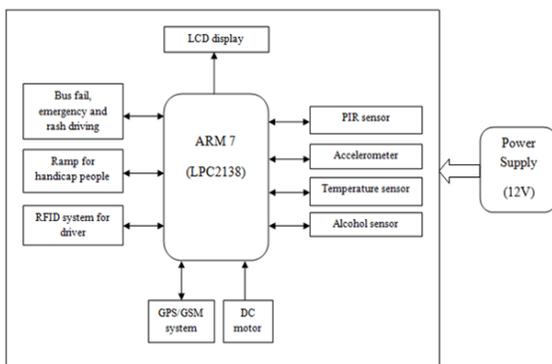
In C.Prabha[12], This paper presents vehicle accident detection and ready framework with SMS to the mobile numbers specified by the victim. The GPS tracking and GSM alarm based algorithm is designed and executed with LPC2148 MCU in embedded framework area. The proposed Vehicle accident detection framework can track geographical data consequently and sends an alert SMS in regards to accident. Trial work has been completed precisely. The outcome demonstrates that higher affectability and precision is to be sure accomplished utilizing this project. EEPROM is interfaced to store the mobile numbers for all time. This made the project more easy to use and dependable. The proposed technique is checked to be profoundly valuable for the automobile sector.

In VarshaGoud[14], This paper gives the outline which has the advantages of being economical, easily movable, small size and simple expansibility. The platform of the framework is ARM alongside MEMS, Vibration sensor; GPS and GSM, interfacing which abbreviates the caution time to an expansive degree and find the site of accident precisely. This framework can solve the issues of scarcity of automatic model for accident location

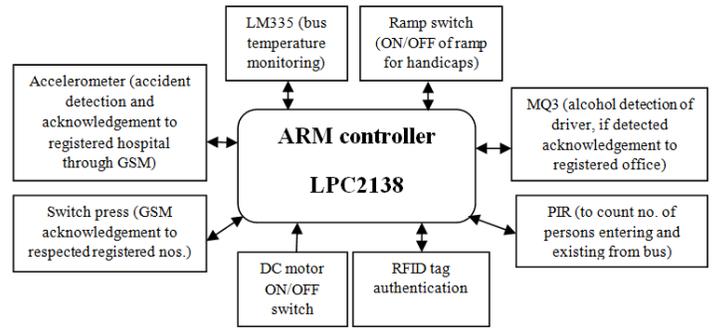
detection. Thus, the time for finding out the area is decreased and the individual can be treated at the earliest opportunity which will spare many lives. This framework will have expansive application prospects as it incorporates the positioning frameworks and the system of emergency health care services. The accident can be distinguished by both vibration sensor and MEMS sensor which will give the precise data. The controller will handle the information, when information is received by it and the alarm is ON and message is sent through the GSM module. The geographical coordinates and the time and the site of the accident is identified by the GPS module. A substitute condition is given by pressing a switch, to interrupt the flow of sending the message if there should be an occurrence of no injuries; this will save time of medical emergency services and unnecessary disturbing which makes panic in such strange conditions. The accident area automatic detection will help us to give security to the vehicles and to the lives of the general population. The high value is given to the lives of the general population. Thus, this paper gives a plausible answer for traffic risks and it offers security to vehicle and lessens loss of human lives and property.

In F.Wahl[17], By utilizing a genuine test organization in an office building, we got execution figures for our sensor models. The outcomes affirmed our way to deal with bearing location and in this manner the potential for individuals numbering per office space. Thusly we utilized observationally got PIR sensor qualities to investigate the execution of two individuals include estimation calculations an office floor reproduction. Our reproductions affirmed that the probabilistic separation based calculation can beat a more basic bearing based numbering. Our kin including methodology could be connected any (office) building including bigger open office spaces, where subspaces can be characterized utilizing virtual passages. The evaluated individuals tally per building space is a key data to progressively control building frameworks identified with HVAC and lighting.

### III. BASIC BLOCK DIAGRAM FOR SYSTEM



**Figure 01: Functional diagram for Smart Public Transport System.**



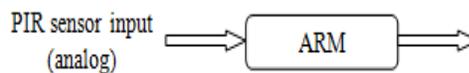
**Figure02 : Methodology for system execution.**

#### Explanation-

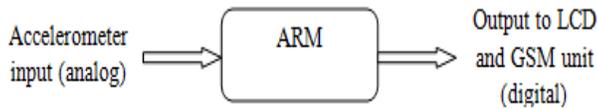
1. ARM (LPC2138): This square is heart of our framework. It works as CPU unit. It forms every one of the information of the sensor and showcases it on LCD and respected output gadget. It is essentially utilized as a result of N no. of sensors associated with the controller. It is chosen since it has capacity to process parallel information and at the time it keeps up the match up in the framework. This controller has 3-stage pipeline which helps in quick process. As it has 40 GPIO pins, it makes simple of accessibility to associate  $2^{40}$  sensors to it. Here, it takes contribution from different sensors (both simple and advanced) and forms it to required yield.

2. Switches (4-leg push-catch): Five switches are utilized for different applications. It's a 4-leg push-button switch. At first it's "released" and when "pressed" it considers an input. The different applications utilized for switch are Emergency switch, Rash driving switch, Ramp switch, Location following switch and System ON/OFF switch. Switch acts as a hinder to controller and after that the controller serves the necessity of the switch. In the event that it's area following switch, it brings the scope and longitude of the area at that specific moment and shows on LCD and in the meantime gives the area on brilliant application for following.

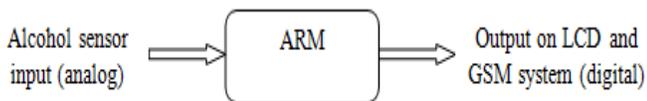
3. PIR sensor unit: This unit goes about as an input to the processor. It's associated with the ADC input stick of the controller. As the sensor is a simple sensor, it takes in simple info and assesses it to the control unit. At that point, the control unit changes over simple signs into advanced ones and helps it to show on LCD unit and in the meantime additionally refreshes the individual depend on the shrewd application for individual accessibility area.



1. **Accelerometer (ADXL335):** This unit is used for accident detection and acknowledgement system. The input the control unit is analog as it's an analog sensor. It gets shocks/vibrations as input and passes it to the controller. It is programmed to detect accident at 700 at X-axis and Y-axis. The controller converts the analog input into digital and generates output at GSM port and LCD display respectively.

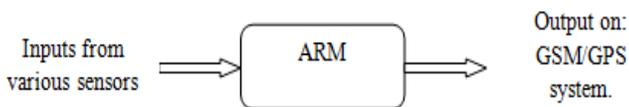


2. **Alcohol sensor (MQ3):** This sensor is connected to ADC pin of ARM. As the sensor is an analog sensor, also known as CO<sub>2</sub>/gas sensor. It detects the change of alcohol % in the air. It acts as input to controller and controller converts the detected level into digital value and displays as output on LCD and GSM system. The % level of detection of alcohol is set to 80mg.



3. **Temperature sensor (LM35):** This sensor is generally used to detect the temperature of an environment. It's an analog sensor, so connected to ADC pin of the controller. Input to the sensor is analog temperature value and the sensor acts as input to the controller. Then, the controller converts the analogy temperature value into digital and continuously displays it on LCD.

4. **GSM/GPS unit (SIM900):** These units are connected to the GPIO ports of the controller. The GSM unit is used to acknowledge the system via SMS to the registered nos. and the GPS system is used to collect the real-time co-ordinates for the system. These units are connected at the output of the system. The GSM/GPS unit drives output for accelerometer, alcohol sensor, rash driving switch, emergency switch, location tracking switch, and PIR sensor respectively. The GSM/GPS port is serially connected with the system.



5. **RFID reader (EM-18):** This unit is used as authenticator for the system. The input to the reader is RFID card. The reader decodes the serial no. of the card and if the no. matches the code then it provides us authentication to operate the system, up to that the system will not start. To make the authentication visible, a LED is mounted to glow.

#### IV. METHODOLOGY

- a. As compared to Indian technologies; till 2010 there were complete mechanical public transports used. Especially talking about bus as transport system, till date traditional i.e. mechanical system are still used.

- b. But, there as technology is developing, there are significant changes that took over traditional once. For ex. Private transport are far better in technology as compared to public transport by government once. They include, automatic light control, GPS tracking, WIFI, A.C., T.V. unit and any more.
- c. While government transport system are still mechanical. Now-a-days, government buses in Pune, Maharashtra are also developing. For ex. Volvo, it includes facilities such as; A.C., digital display for next stop indication along with announcements, emergency door exists.
- d. Another ex. Is Rainbow bus. This bus has all features such as Volvo, the only difference is that bus stops are modernized. The stops have automated door opening and closing when bus arrives at the stop. The door that the stop senses is emergency door. The stops also have digital LCD displays showing list of bus to arrive and depart from stops along with their timings.
- e. Also in other states such as Gujarat, Karnataka, West-Bengal, Punjab, etc the public transport system are more advanced than Maharashtra.

- **Hardware:**

- For hardware basic technology to be used is GPS/GSM technology for bus tracking and monitoring.
- Accident detection technology for vehicles is to be used for accident detection and GSM technology to be used for its monitoring.
- PIR sensors are to be used for counting of public that travelled in the bus at front and rear door. Temperature sensor is used to monitor temperature of the bus.
- Safety switches along with SMS acknowledgment to registered police station are used as indicators for rash driving, bus fail and emergency case.
- RFID authentication is used for driver, and ramp for handicap people so that it becomes convenient and easy for them to use public transport.

- **Software :**

- Android application is to be developed for smart phones to make the bus tracking and monitoring easy and fast.
- For the controller i.e. for ARM7 processor Embedded C language is used for programming.

● **System Developing and Testing:**

- For Hardware: Flash Magic for program burning, Dip trace for PCB designing and android emulator for application testing.
- Keil4: Used for program debug and simulation.
- Java IDE (Eclipse Luna): Used to develop java environment for serial communication between prototype and PC.
- MySQL: Used to create database for mobile app.

V. ALGORITHM FOR SYSTEM EXECUTION

● **Setup for prototype:**

1. Hardware prototype to be connected with adapter.
2. Antenna to be connected with GPS unit and free the antenna in free sky.
3. Connect the prototype with laptop.
4. Open the Java IDE setup.

● **Algorithm for hardware demonstration:**

1. Initialize the hardware.
2. Grant access to the system using RFID unit.
3. Initialize LCD and sensors.
4. LCD displays: Initial value of Temperature sensor, Value of Accelerometer in X-axis, Value of Alcohol sensor and PIR sensor count.
5. If system ON/OFF switch pressed, start the system moment.
6. When the value of MQ3 sensor changes i.e. if the value of alcohol content changes, the GSM system sends a SMS acknowledgement to the registered no. that the driver is drunk and real-time co-ordinates of the location. The alcohol contents can be changed by spraying a perfume or by taking alcohol closer to the sensor manually.
7. When an accelerometer is been vibrated or shocked, it detects accident when the X-axis and Y-axis changes above 300gravity and 700gravity respectively. Then, the GSM unit sends an acknowledgement SMS to the registered mobile no. containing the message of accident detection and real-time co-ordinates of the location.

8. If location tracking switch is pressed, then it tracks real-time location for tracking the system. This location is displayed on map on smart app.
9. While, at entry and exit gate of the system PIR sensor are mounted for person count. Increment of person count is at entry gate and decrement of person is at exit gate. Then, the sum of increment and decrement is display on smart app.
10. When ramp switch is pressed, opening and closing of ramp is done.
11. When emergency and rash driving switch is pressed, they acknowledge SMS through GSM unit with GPS co-ordinates to the registered.

● **Algorithm for software demonstration:**

1. Open the Eclipse Luna (Java IDE).
2. Select the main page and run as java application. Then, select com port to which system is connected through USB port.
3. Set all the properties i.e. baud rate, parity bits, start and stop bits accordingly.
4. As soon as properties are set, it displays no. of persons available and when location tracking switch pressed, it gets the location as latitude and longitude values on the main page.
5. Then, run the main project on run on server and then finish by selecting Tomcat v8.0 Server at local host.
6. Then, the application page on browser opens.
7. At homepage, search options are provided for bus searching.
8. When searched for bus, it displays the bus details and location to track the bus.
9. If track pressed, then on Google map displays the current real-time location of the bus.

VI. EXPERIMENTAL RESULTS AND ITS DISCUSSION

1. **HARDWARE RESULTS**

Fig.25 represents top view of the system. It represents the hardware prototype (robot) built to represent public transport system bus. Fig.26 shows prototype setup for the system. The setup includes hardware and PC.



Figure 03: Prototype implementation of the system.



Figure04 : Setup for demonstration.

Fig.27 represents output for ramp for handicap people. The ramp is designed using CD drive. Fig (a) represents opening of ramp and fig (b) represents closing of ramp. Opening and closing of ramp is operated with help of switch.

## 2. SOFTWARE RESULTS

Fig.30 shows smart app designed and installed in mobile phone of user.



Figure05 : Smart app for the system on menu.

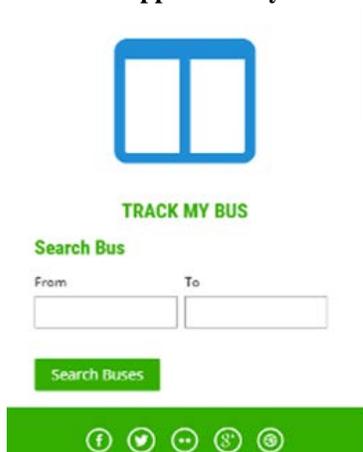


Figure 05: Smart app GUI.

Fig.32 represents bus details and bus location tracking on smart app.

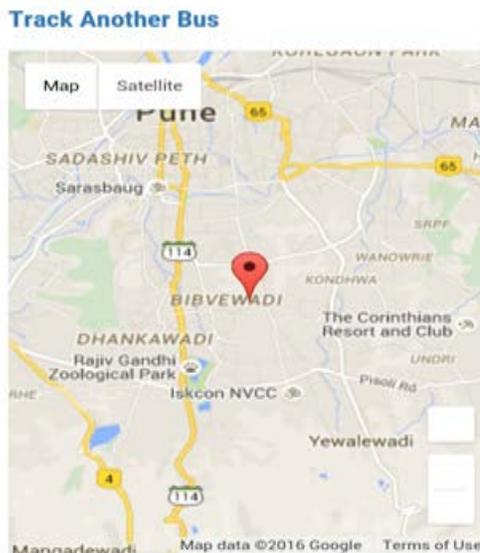


Figure06: Result of smart app for the system tracking and person availability.

## VII. CONCLUSION

The system to be designed is fully secured and smart assisted public system. The implementation of the system is to be done for bus. ARM7 processor is used as controller to control the whole processing [4]. A system prototype is developed for testing of three sensors i.e. accelerometer, bus fail switch and PIR sensors. The PCB is developed on glass epexicresion material. PCB is single layer PCB. Designing and layout of PCB is done on Dip trace tool due to its ease of availability and use. Required testing programs are developed for testing of sensors. The coding is been done using Keil4 software version. The code burning is done by using Flash Magic tool with baud rate of 9600bps. The system overcomes basic mechanical, Volvo and BRT systems. It's more secure, smart and advanced. As emergency switch, bus fail switch and accident detection is added the system becomes secure. The system is smart and advanced as it has various features of alcohol detection, GPS tracking, GSM acknowledgement, ramp for handicaps, etc.

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# Human Capital and Economic Convergence in Indonesia : An Empirical Analysis

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**Abstract-** This study examines conditional convergence using the Regional GDP variable per capita of initial government expenditure, domestic investment, inflation and the number of high school graduates as an important human capital in  $p$  and the dependent variable is the average per capita Regional GDP in twenty six provinces in Indonesia to determine whether There has been conditional convergence ( $\beta$ ). The results showed that all provinces in Indonesia are still experiencing divergences. Initial per capita Regional GDP has a significant and positive effect on conditional convergence ( $\beta$ ), the increase in government spending will increase conditional convergence ( $\beta$ ). domestic investment positive but not significant, significant and negative inflation towards conditional convergence ( $\beta$ ), the number of high school graduates is negative and significant to conditional convergence ( $\beta$ ). The decline in the number of high school graduates increases the value of conditional convergence ( $\beta$ ).

**Index Terms-** Conditional Convergence ( $\beta$ ), human capital, Human Resources

## I. INTRODUCTION

Human capital has a very important role in supporting the development of the Indonesian economy because human resources become the subject of development that has a central role in managing resources owned in Indonesia. Economy. Todaro (2006: 11-12) defines economic development as a multidimensional process that includes structural change, attitude and institutional life. In addition, economic development includes increasing economic growth, reducing inequality income distribution and poverty eradication, to produce a series of economic advancements that are truly beneficial and through an efficient process.

Economic growth is influenced by the accumulation of physical capital and the accumulation of human capital. Both types of capital is an important factor that determines economic growth. Stern (1991: 128) states that the accumulation of physical capital and human capital is a determinant of growth. Economic growth followed by equal distribution of income became one of the goals of achieving economic convergence.

According to Islam (2003), how the income level of poor countries will converge to rich countries by themselves so as to have implications for human well-being. According to Barro and Martin (2004: 17), one of the predictions of the Solow (1956) and Swan (1956) models, which have been taken seriously as empirical hypotheses in just the last few years is the occurrence of conditional convergence. The lower the rate of initial per capita GDP relative to the long-term or steady-state position, the faster the growth rate. The determinants that influence the economic convergence can be domestic investment consisting of PMDN and PMA, and government expenditure on the province in Indonesia. Then added with variable number of high school graduates to know the role and influence of human capital on economic convergence. Thus put forward the problem is how the influence of macroeconomic variables factors (government spending, domestic investment, inflation and human capital) in influencing economic convergence.

## II. RESEARCHS ELABORATIONS

The basic theory of economic growth and the convergence of income is linked to the linkage between openness and economic growth. The hypothesis that openness can lead to better economic performance and contribute to the process of convergence of income between poor countries and the rich economy is supported by new growth theories.

Two concepts of convergence are discussed in Barro and Sala-i-Martin (1990 and 1992), Salai-Martin (1994), Bernard and Durlauf (1996) and Raiser (1998), and others. The first is the convergence of  $\beta$  which describes the inverse relationship between the level of initial income and growth. If an initially poor economy grows faster than the former is richer, there is a convergence of  $\beta$ . The other is the convergence of  $\delta$  that focuses on the inequality of actual income between regions or countries. If income

inequality decreases, the region or economy in question reaches the convergence of  $\delta$ . It should be noted that the convergence of  $\beta$  is a necessary but inadequate condition for  $\delta$  convergence, or  $\delta$  convergence including  $\beta$  convergence, but not vice versa.

### III. FINDINGS

#### 1. Conditional Convergence with Variable Human Resources in Indonesia

To analyze the convergence of human resources, the number of residents who completed high school education for the 26 provinces included in the six corridors are Sumatra Island corridor, Java Island, Bali Island and Nusa Tenggara, Kalimantan Island, Sulawesi Island and Maluku Island and Papua. Based on the results of the research shown in Table 1.

Calculation of conditional convergence is done by using explanatory log variables per capita GDP (YCit-1) and then added with variables as determinant of growth rate of GRDP per capita consisting of government expenditure (Gi), domestic investment (PMDN), Inflation and Number of population SMA. Penghitungan conditional convergence is using panel data regression analysis with Fixed Effect Model approach. The use of the model is selected through the F test and Hausman test.

Based on Table 1, It can be seen that the value of R-squared is equal to 0.9955 or 99.55% which means 99.55% variation of initial GRDP variable, government expenditure, PMDN, inflation and Number of high school population in the model can be explained by PDRB variable (0.45% ) Is influenced by variables outside the model. If seen from the probability value of F statistic 0.000 < 0,05 means that initial GRDP variable, government expenditure, PMDN, inflation and high school population together have significant effect to PDRB.

$$\text{Convergence-}\beta = 0.290627 + 0.890798 (\text{Initial GDP}) + 0.25050 (\text{Government Expenditure}) + 0,000883 (\text{PMDN}) - 0.020273 (\text{Inflation}) - 0,040981 (\text{Population SMA})$$

Based on the above equation it can be explained that with the initial estimation coefficient (parameter) of real per capita GDP is positive and significant with coefficient value of 0.890798 means that any one percent increase of PDRB per capita will cause divergence instead of  $\beta$ -convergence to be 0, 890798 percent, while the coefficient of government expenditure also statistically have a positive and significant effect. In the variable of routine expenditure, the coefficient value is 0,025050, meaning that every increase of one percent of routine government expenditure will increase the value of the  $\beta$ -convergence. This can happen because the Indonesian government is active in the development process in various economic sectors is also very instrumental in realizing the  $\beta$ -convergence. The PMDN variable shows a positive but not significant relationship. Based on the coefficient value 0.000883 means any increase of one percent of PMDN will not cause the convergence- $\beta$ . The inflation variable shows a negative and significant direction. Based on the coefficient value of 0.020273 means that any increase of one percent inflation will decrease the value of  $\beta$ -convergence. The variable of Indonesian population with high school education shows significant relation with coefficient value of -0,040981 meaning that every increase of one percent of Indonesian population with high school education leads to  $\beta$  convergence.

Table 1. Estimation of Conditional Convergence Regression With Fixed Effect Approach

Variable	Koefisien	Std. Error	t-Statistik	Probabilitas
Constanta	0.290627	0.076031	3.822484	0.0001
Log early per capita Regional GDP	0.890798	0.018321	48.62157	0.0000
Log GovernmentExpenditure	0.025050	0.003680	6.806648	0.0000
Log Domestic Investment	0.000883	0.000835	1.056644	0.2912
Log Inflation	-0.020273	0.002194	-9.238091	0.0000
Log High School	-0.040981	0.014588	-2.809152	0.0052
<i>Fixed Effects (Cross)</i>				
Aceh	-0.043219			
North Sumatera	0.006600			
West Sumatera	0.005686			
Riau	0.086772			
Jambi	0.017142			
South Sumatera	0.006630			
Bengkulu	-0.021169			
Lampung	-0.014658			

Dki Jakarta	0.125034
West Java	-0.023974
Central Java	-0.032579
Di Yogyakarta	-0.020779
East Java	0.003228
Bali	0,004527
West Nusa Tenggara	-0.042762
East Nusa Tenggara	-0.099360
West Kalimantan	-0.021452
Central Kalimantan	-0.030820
South Kalimantan	-0.011070
East Kalimantan	0.135776
North Sulawesi	0.010742
Central Sulawesi	-0.005940
South Sulawesi	0.002033
Southeast Sulawesi	-0.006768
Maluku	-0.072946
Papua	0.034165
R-squared	0.995519
Adjusted R-squared	0.995241
Durbin-Watson stat	1.934459
F-statistic	3583.943
Prob(F-statistic)	0,000000

Source: Central Bureau of Statistics 1995-2015 (Processed 2017)

## 2. Conditional Convergence with Variable Human Resources in Western Indonesia Region

Based on the results of the research shown in Table 2, obtained R square of 0.995784 which shows that 99.58% of the average GRDP per capita can be explained by the model used.

Based on the F test results, the independent variable significance is shown by the probability value  $F = 0,000 < 0.01$  (ie the value of  $\alpha = 1\%$ ) it can be said that together the initial GDP per capita, government expenditure, PMDN, inflation and population High school graduates have an effect on average GRDP per capita, in other words changes to 5 (five) variables together will affect the convergence in the West Indonesia region.

While based on t significance t significance is smaller than 0.05, even smaller than 0.01 for Early GRDP variable (0,0000), government expenditure (0,0000), and inflation (0,0000), whereas for variable number of population graduates SMA, significance level  $t > 0.10$  ( $\alpha = 10\%$ ) it can be said that partially affect the occurrence of economic convergence or divergence. These findings support previous research conducted by Konya and Guisan (2008: 9) in African convergence measured by living standards with the Human Development Index (HDI) consisting of productivity.

Furthermore, based on the coefficient of negative signified in 9 (nine) provinces of Aceh, Bengkulu, Lampung, West Java, Central Java, DI Yogyakarta, East Java, West Nusa Tenggara and East Nusa Tenggara. The other 7 provinces have positive coefficient signs, namely North Sumatra, West Sumatra, Riau, Jambi, South Sumatra, DI Jakarta, and Bali. These results are also consistent with expected expectations, and in accordance with previous studies from Coulombe and Lee, 1955, found convergence in almost all Canadian provinces from 1961-1991, and Cashin 1995, indicating that there is convergence in seven Australian states. In accordance with previous opinions from Friedman (1992) and Hotelling (1933) which states that convergence in certain groups of countries has shown a decrease in income gaps within the group over time.

Table 2. Estimation of Conditional Convergence Regression with Human Resource Variable in West Indonesia Region

Variable	Koeffisien	t-Statistic	Prob.
Constanta	0.206116	2.406016	0.0167
Log early per capita RGDP	0.847990	35.33994	0.0000
Log GovernmentExpenditure	0.033246	7.326965	0.0000

Log Domestic Investment	0.001568	1.304901	0.1929
Log Inflation	-0.018815	-6.996759	0.0000
Log High School	-0.026853	-1.736745	0.0835
Fixed Effects (Cross)			
ACEH--C	-0.026581		
_NORTHSUMATERA--C	0.000835		
_WESTSUMATERA--C	0.005576		
_RIAU--C	0.134280		
_JAMBI--C	0.038353		
_SOUTHSUMATERA--C	0.012281		
_BENGKULU--C	-0.027796		
_LAMPUNG--C	-0.017141		
_DKIJAKARTA--C	0.167429		
_WESTJAVA--C	-0.048523		
_CENTRALJAVA--C	-0.057831		
_DIYOGYAKARTA--C	-0.017824		
_EASTJAVA--C	-0.011328		
_BALI--C	0.015372		
_WESTNUSATENGGARA--C	-0.050176		
_EASTNUSATENGGARAR--C	-0.124450		
<hr/>			
R-squared	0.995784	Mean dependent var	6.374854
Adjusted R-squared	0.995499	S.D. dependent var	3.065602
S.E. of regression	0.083823	Sum squared resid	2.079775
F-statistic	3495.707	Durbin-Watson stat	1.866704
Prob (F-statistic)	0.000000		

Source: Processed data, 2017

### 3. Conditional Convergence with Variable Human Resources in Eastern Indonesia Region

In order to analyze conditional convergence by adding variable human resources that is the number of population of high school graduates in eastern Indonesia region. Based on the results of the research shown in Table 3, obtained R square of 0.996032 indicating that 99.60% of the average GRDP per capita can be explained by the model used.

Based on the F test results, the independent variable significance is shown by the probability value  $F = 0,000 < 0.01$  (ie the value of  $\alpha = 1\%$ ) it can be said that together the initial GDP, government expenditure, PMDN, Inflation, and the number of high school graduates Affect the average GRDP per capita, in other words changes to the 5 (five) variables together will affect the convergence in eastern Indonesia.

Table 3. Estimation of Conditional Convergence Regression with Variable Human Resources in Eastern Indonesia Region

Variable	Coeffisien	t-Statistik	Prob.
C	0.665715	3.022049	0.0029
LN <sub>X1</sub> ?	0.947829	33.89469	0.0000
LN <sub>X2</sub> ?	0.019165	2.422053	0.0164
LN <sub>X3</sub> ?	-0.000483	-0.408714	0.6832
LN <sub>X4</sub> ?	-0.021307	-5.501767	0.0000
LN <sub>X5</sub> ?	-0.120459	-2.565526	0.0111
Fixed Effects (Cross)			
_WESTKALIMANTA--C	-0.006131		
_CENTRALKALIMANTAN--C	-0.035581		

_KALIMANTANSELA	
TAN--C	-0.009097
_EASTKALIMANTAN	
--C	0.049934
_NORTHSULAWESI--	
C	0.023772
_CENTRALSULAWES	
I--C	-0.004412
_SOUTHSULAWESI--	
C	0.053282
_SOUTHEASTSULAW	
ESI--C	-0.009415
_MALUKU--C	-0.052266
_PAPUA--C	-0.012172

R-squared	0.996032	Mean dependent var	5.987245
Adjusted R-squared	0.995728	S.D. dependent var	3.213619
S.E. of regression	0.080627	Sum squared resid	1.189622
F-statistic	3280.868	Durbin-Watson stat	2.114937
Prob(F-statistic)	0.000000		

Source: Processed data, 2017

While based on t significance t significance smaller than 0.05, even smaller than 0.01 for Early GRDP variable (0,0000), and inflation (0,0000), while for government expenditure variable and the number of high school graduates, the level of significance  $t > 0.10$  ( $\alpha = 10\%$ ) then it can be said that the partial effect on the occurrence of economic convergence or divergence. These findings support previous research conducted by Bautista (2000: 85) on convergence in human capital between 31 states and the Federal District in Mexico, using the education index.

Based on the coefficient value that is marked negative there are 7 (seven) provinces of West Kalimantan, Central Kalimantan, South Kalimantan, Central Sulawesi, Southeast Sulawesi, Maluku and Papua. The other three provinces have positive coefficient marks, namely East Kalimantan, North Sulawesi, and South Sulawesi.

#### IV. CONCLUSION

Based on the research results it can be concluded that conditional convergence ( $\beta$ ) has not occurred in 26 provinces in Indonesia. This is because the process of development in the provinces in Indonesia is still ongoing, still requires a large government spending to provide good infrastructure and infrastructure, PMDN, stable inflation and high quality human resources.

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# Compressed Air Engine

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**Abstract-** Mankind is always looking for efficient and pollutant-free way of powering their machine. Recent development in light and strong material has aided us to achieve those easier ways. In present study a 4 stroke engine was modified into 2 stroke engine, and was used to run on compressed air technology. Some test was performed on the modified engine to study the effectiveness of the engine.

**Index Terms-** Compressed air Technology, Valve, Compressed air Tank, Heating filament.

## I. INTRODUCTION

The present situation of depletion in fossil fuel and high rise in price of gasoline has forced researchers to find other sources of energy to replace fossil fuel. Some presented the idea of electric motor, hybrid engine and newly developed Compressed Air Engine (CAE). A Compressed Air Engine is a type of engine which uses compressed air technology to generate useful work output. The idea is to store compressed air inside a tank. The compressed air inside the tank has large amount of energy, and this energy can be used to move the piston of an engine. The back and forth movement of piston inside the engine cylinder results in generation of useful work energy.

## II. History

The history of Compressed Air Technology (CAT) is not new to industries. Pneumatic pressure stored in tanks with the use of CAT has been used to drive many pneumatic based devices in industries. The use of CAT did not remain to just industrial application but has been also applied for driving the vehicle. CAT was first used for running a vehicle in 18<sup>th</sup> century (Mishra & Sugandh, 2014, p. 99). The energy from the CAE was used to power a train by Tramway de Nantes in France (Mishra & Sugandh, 2014, p. 99). The use of CAT to power an engine did not earn much audience due to some technological disadvantages and the easy availability of gasoline. However, Charles B. Hodges not only invented a car to be powered by a compressed air engine but also achieved success in finding great use for commercial industries (Mistry Manish K, Rathod, & Arvind, 2012, p. 271). Charles work on CAE brought a possibility to use CAE in small cars. In 2002 an engine with two stage was developed by Motor Development International (MDI) to easily fit inside a commercial car (Thipse, 2008). This engine overcame many disadvantages of early CAE engines and was more efficient in working. The engine developed by MDI also has a greater value of torque when compared with early CAE engine. Further, the Indian motor giant TATA announced to manufacture CAE powered car, with hopes of offering it directly to consumers, in 2018 (Lampton, p. 4). The work on the current CAE still need to overcome some disadvantages of recharging the compressed air tank. Big carmakers are still waiting for some major development in the

CAE based car before putting their hand in the production of such car (Lampton, p. 4). Hence, the co-development by MDI and TATA give the new possibility of powering a car with CAE.

### **III. Parts of CAE**

A new generation Compressed Air Engine consist of highly engineered parts to ensure smooth running and high efficiency. The design of CAE consists of compressed air tank, throttling valve, piston engine and exhaust tail. The car will have an inbuilt compressor which will use the surrounding air to refill the compressed air tank (Lampton, p. 4). A compressed air tank is very important part of CAE. A compressed air tank is a container where highly pressurized compressed air is stored. Thus, a compressed air tank act like a powerhouse for the CAE and is responsible for driving the piston engine (Lampton, p. 1). The energy inside a Compressed air tank comes from highly pressurized air. However, the increase in the value of pressure inside the container can lead to busting of container (Thipse, 2008, p. 36). It is necessary to build a container with higher strength to sustain such high value of pressure. One such solution is increasing the thickness of the container walls. Increasing the thickness can give the structural strength to container, but at the same time it increases the weight of the container. The increase in weight of the container is not favorable while designing a car. The compressed air is not easy to store in compact vessel while considering the weight reduction of car (Edelstein, 2015, p. 2). Thus, there is a need of some high strength material to design a container (or a compressed air tank), which is light in weight at the same time. According to LeGault (2012) "The higher modulus and fracture toughness afforded by the silica-filled epoxy/carbon fiber composite enables a tank design that weight less but has greater capacity in same footprint" (p. 4). A tank made of carbon fiber will help in avoiding the risk of busting by giving enormous strength and at same time it will be lighter in weight. The carbon fiber compress air tank will have an outlet, passing through the throttling valves, connecting the inlet of the engine.

An engine is a device which convert one form of energy into a useful output work. The basic design of an engine consists of a piston, an engine cylinder, a set of inlet-outlet valve and a crankshaft. According to Mishra & Sugandh (2014), "A compressed air engine is a type of engine which does mechanical work by expanding air" (p. 99). Following the similar footprint of conventional engine, a compressed air engine uses pressure from atmospheric air stored in a compressed air tank as a fuel to provide the require pressure to move the piston. According to Lampton (n.d.), "compressing a gas into a small space is a way to store energy, when the gas expands again, that energy is released to do work" (p. 1). A throttling valve is provided between the compressed air tank and the air engine to check the amount of air flow into the engine from compressed air tank. As the inlet valve opens the engine comes in direct contact with the compressed air stored in the tank. The high-pressure air rushes into the engine chamber for the expansion. According to Thipse (2008), "The expansion of the compressed air drives the piston to create movement, replacing the burning of fossil fuel in a conventional engine" (p.34). The expansion of compressed air takes place when the engine piston is at TDC. The compressed air acting on the surface of piston head leads to the development of high pressure on the piston head. The

highly pressurized air passed into the engine chamber pushes the piston and creates the movement of piston from TDC to BDC (Manish, Rathod, & Arvind, 2012). This simple process helps an engine to run in a smooth and efficient way.

An engine for commercial production needs to be efficient with high power output. Today consumers want a car which sets perfect with their pocket but have the same work power like conventional cars. This can be only achieved by fulfilling important criteria of the customers: If the energy required to power the car is easily available and is cheaper. The car should have high power and torque. CAE advantageously meets the first criteria of the customers as it uses the normal surrounding air as a fuel to run the engine. The air around us is in abundant volume and is also free as discussed above. Further, the second requirement of the car buyer is the power and efficiency of the engine to do their required work. An engine is best graded by its efficiency. An engine is always compared with other engines based on its efficiency. Efficiency of an engine means how much output energy it can produce for a given amount of input energy. The energy efficiency of CAE can be given as the ratio of output energy produced by the engine to the input energy applied to the engine (Yu & Cai, 2015, p. 147). Therefore, after successfully fueling the CAE with cheaper energy, the second important task was to obtain higher power output from the compressed air. The basic object of using compressed air technology is to obtain a higher value of work output for considerably less amount of input energy (in form of compressed air) from a CAE (Mishra & Sugandh, 2014, p. 100). The actual power of the engine can be only determined by experimental observation and mathematical calculation. An experiment model designed of CAE shows that when the throttling valve is opened to allow large flow of compressed air into the engine chamber, it results in the faster speed of the car with a highest value of torque output (Wang, You, Sung, & Hang, 2014, p. 64). Thus, this gives an experimental proof that a CAE has much better torque to do work like conventional engine. However, the torque generated by CAE keeps on decreasing with the decreasing pressure inside the compressed air tank. Thus, a compressed air needs to overcome such disadvantage. On September 15, 2004, Di Pietro came up with a new design CAE which he claimed to be 100% more efficient than any other type of CAE to the date and the torque output was much better to power a car (Hanlon, 2004, paragraph 1). This development so far gives an opportunity for the car makers to look for a better possibility to power their vehicle with an engine which overcomes fuel crises and at the same time stands out to be a greener source of energy.

#### **IV. Global Warming: Present threat to earth**

Today the greatest threat to life on earth is global warming. To combat global warming different nations are pushing their researchers and scientists to find out the ways for the energy source which are unlimited and greener at the same time. One such possibility is coming through the development of CAE. A car powered by CAE will have zero value of pollutant emission from its tail which will make it ideal for using in cities which have high level of pollution issues (Manish, Rathod, & Arvind, 2012, p. 1). CAE is believed to claim the podium for the greener way of generating energy. CAE uses the normal air to generate energy. Unlike any conventional combustion engine which uses the combustion of fuel to generate energy, a CAE does not involve burning of carbon-fuel, due to which there is no change in the form of molecules in the intake air. Thus, the air coming out of the

engine exhaust is same as the air sucked by the CAE. According to Mishra, & Sugandh (2014), “Without any combustion the motor is driven by the compressed air in which after combustion, dangerous and harmful gases were comes out which results in zero pollution mobility concept ideal for current global warming concerns which makes the environment eco-friendly” (p. 100). CAE can be considered as a breathing engine which just inhale and exhale the air. A clean way to generate energy give an advantage to CAE, such that it can be used to power automobiles to reduce the pollution from their tails (Lampton (n.d.)p. 2). Further, it has been found that the exhaust air coming out of the CAE has lower temperature in comparison to the hot air going inside the engine. According to Thipse (2008), “The temperature of the clean air expelled from the exhaust pipe is between 0 to -10 degree and can be channeled and used for air conditioning in the interior of the car” (p. 36). Thus, the exhaust air from the CAE will be utilized to further obtain the work of cooling without consuming any extra energy.

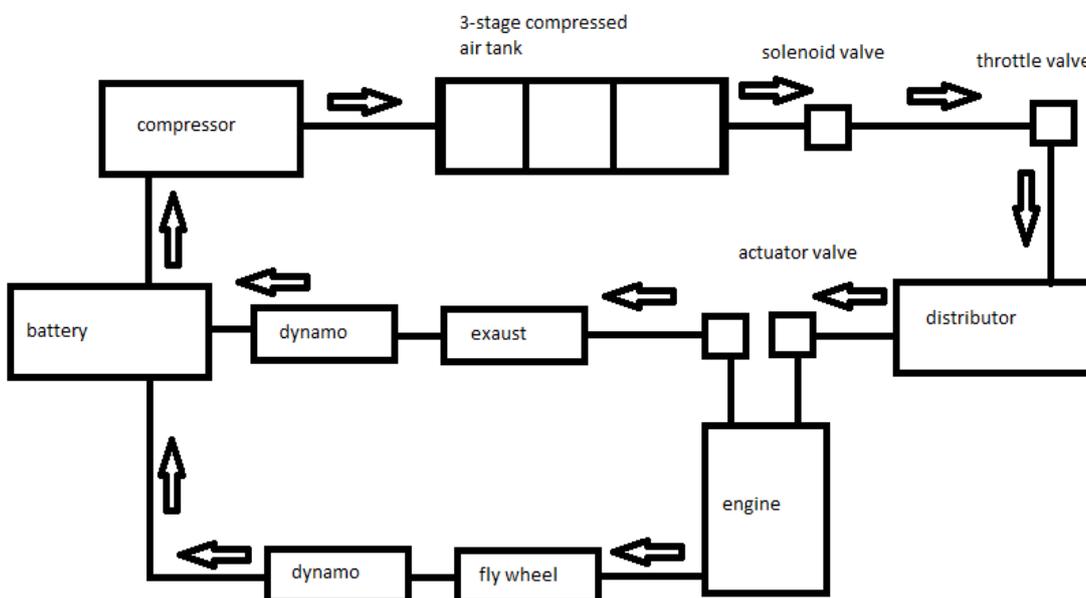
### V. Overview of this paper

The review of literature gives a brief introduction to the evolution of CAE; it presents the problem of leakage and inefficiency that are faced while designing the components of CAE and how they can be overcome. Further, it also covers the advantages of using CAE in reducing the energy crises and lowering the global warming. However, the concept of running the car using CAE still need some focus in developing infrastructure to power the car. This paper presents the concept of my CAE design, presents the concept of modifying a conventional 4-stroke internal combustion engine into a 2-stroke engine to run using compressed air technology, presents the basis for my CAE testing, and discusses its advantages and give an overview on CAE future development.

### VI. The layout of my CAE design

The proposed design consists of systematic arrangement of apparatus to generate energy from the engine in optimized way.

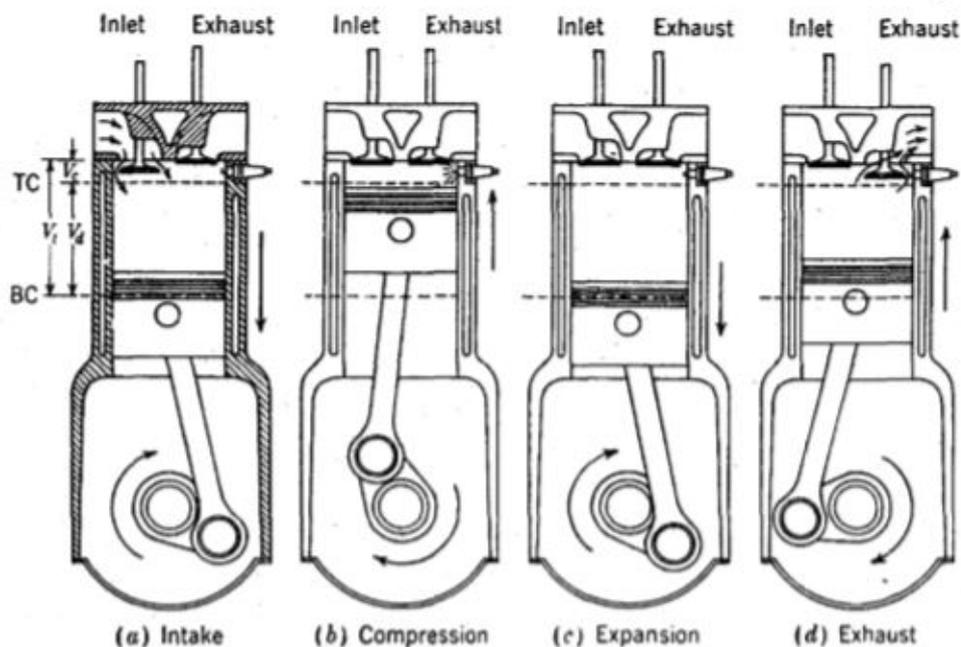
Figure 1: circuit diagram of CAE



The above circuit diagram can be explained as follows: the first engine will be equipped with a compressor to compress the air into the compressed air tank. According to Noh, et. al. (2016), "The optimization of compression part design is the most fundamental and important factor" (p. 44). Thus, designing a CAE car equipped with compressor will aid to the generation of on board compressed air energy to run the car. However, the compression of gas in a tank is a critical and time taking process. According to Krudi, et. al. (2014), "Designing a pressure vessel for extremely high pressure condition is quite complicated and required detail consideration in many aspects including permissible stress level, definition of operation, failures criteria, material properties" (p. 746). Therefore, once the concept of CAE based car catch up with the market, an infrastructure of compressed air station will be installed. The gas station will allow the car driver to fill the compressed air tank within few minutes. Now the compressed air will reach to the 3-stage compressed air tank. It consists of three chambers as shown in the diagram. The air from the compressor will directly enter to the 1st chamber where a certain amount of pressure will reach and the air will go to the 2nd chamber via pressure valve and finally to the 3rd chamber with the same procedure as above. Further, all the chambers are provided by an air-conditioning element which will allow more compressed air to get stored in the same volume of the tank. A main supply line, transport the compressed air withdrawn from the tank further to the engine. In this line, a key-operated solenoid valve is placed which serves as a selective shut off valve to start and stop the engine. Once the solenoid valve is open, the main supply line delivers the compressed air to the main injectors. This line has a throttle valve arranged downstream which is connected to a mechanical linkage which is operated by means of accelerator pedal (Lee, Shim, & Kim, 2015, p. 24). Now the compressed air enters the distributor. Since the proposed design consist of a multi-cylinder engine, a distributor is used to channel the compressed air into each cylinder equally. The pipe in the distributor consist of many holes which will be equal to the number of cylinders in the engine, along its length. From the distributor, each hole lead a separate line to transport compressed air to each cylinder of the engine. The compressed air is then injected into each cylinder when the piston is at TDC. The accumulation of compressed air over piston head cases the piston to move from TDC to BDC. The piston in each cylinder rotates the crankshaft connected to it. During this time the compressed air expand and cools down. After the first stroke the piston move from BDC to TDC, this causes the cooled air to exhaust through the mechanically operated exhaust-valve (as in conventional internal combustion engine). In the proposed design the cylinder will be surrounded by the heating filament which will cause more thermal expansion of compressed air in the cylinder. Increase in the expansion will help in generating high pressure on the piston head and will help to increases the efficiency of the engine. The exhaust air will be passed through the turbo which will rotate the impeller shaft inside it which is connected to the dynamo at the other end. This technique will be used to generate electricity from the waste exhaust air. Batteries will also be charged from the flywheels using the same technique which can be found in almost every vehicle. The batteries charged from Turbo and Flywheel will be used to drive the compressor and the cycle continues.

### VII. Modification to CAE

To modify a 4-stroke engine into a 2-stroke engine, it is important to understand the working concept of a 4-stroke internal combustion engine. As the name implies, a 4-stroke engine consists of 4 different strokes, namely suction stroke, compression stroke, power stroke, and exhaust stroke. A stroke is defined as the distance travel between TDC and BDC (Shi, Jia, Cai, & Xu, 2015, p. 2). An internal combustion engine also consists of two stroke synchronize valve i.e. inlet valve and outlet valve. (Heywood, 1988, p. 10-11) An inlet valve controls the flow of air-fuel mixture inside the engine chamber and an outlet valve controls the flow of exhaust burned gases out of cylinder chamber. The first stroke of an ideal internal combustion engine starts when the piston is at TDC (Heywood, 1988, p. 10). At this point the inlet valve of the engine also starts opening. During the suction stroke the piston moves from TDC to BDC, this movement of piston causes the decrease in pressure over the piston head and creation of suction. Thus, when the inlet valve opens during the suction stroke, the air-fuel mixture gets sucked inside the engine chamber. The second stroke starts when the piston is at BDC (Heywood, 1988, p. 10). At this point the inlet valve of the engine gets closed and it remains closed till the next end of forth stroke. During the compression stroke the piston moves from BDC to TDC. The movement of piston from BDC to TDC causes the air-fuel mixture to compress and increase of the pressure inside



the engine chamber.

Figure 2: four strokes of engine (Heywood, 1988, p. 10)

The third stroke starts when the piston is again at the TDC (Heywood, 1988, p. 10). At this point the ignition of the air-fuel mixture is triggered by the spark plug inside the engine chamber. The ignition of the air-fuel mixture causes a sudden increase of pressure inside the engine chamber. This high-pressure acts over the piston and pushes the piston from TDC to BDC. The movement of piston causes generation of output power from the engine due to which this stroke is known as power stroke. The fourth stroke starts when the piston is at BDC (Heywood, 1988, p. 10). At this point the outlet valve of engine also starts opening.

During exhaust stroke the piston move from BDC to TDC, this movement of piston pushes the burned-out gasses out of engine chamber through outlet valve opening. The outlet valve just opens for exhaust stroke. In internal combustion engine, the lower end of the piston is connected to the crank shaft. For every stroke of piston, the crank shaft rotates for 90° (Heywood, 1988). Thus, the crank shaft rotates for 720° (or two complete revolutions) during the 4-stroke of the piston (Heywood, 1988). This means in four-stroke engines, a single power stroke is produce every 4<sup>th</sup> stroke. Where as in two stroke engines, a power stroke is produced on every 2<sup>nd</sup> stoke. These all design mechanism were considered while modifying a 4-stroke into 2 stroke engines (Heywood, 1988, p. 10-11).

In the current design, a 150cc 4-stroke spark ignition internal combustion engine was used. To modify this engine into 2-stroke and run it with CAT, modification was done by changing the timing gear configuration of cam shaft, inlet nozzle and valve timing of the engine. The design of engine is a basic 4 stroke engine but, instead of getting a power stroke in alternative revolution this engine was modified to obtain a power stroke in every revolution of the crank shaft. First, modification of cam shaft: originally the cam shaft was designed to run on a four-stroke engine with the opening and closing of an outlet valve at first and fourth stroke respectively. This designed was modified to close and open the inlet and outlet valve at every 180° revolution of crank shaft. Second, modification of timing gear: The speed ratio of timing gear to the crank shaft gear was modified from 2:1 to 1:1, thus providing an equal revolution to the timing gear with respect to the revolution of crank shaft which leads to the conversion of 4-stroke engine into a 2-stroke engine. Third, modification of inlet valve: the carburetor of engine valve is removed and an inlet nozzle is provided so that the outlet of compressed air tank can be connected to the Compressed Air Engine. Fourth, modification of inlet and outlet valve spring: the carburetor of engine valve is removed and an inlet nozzle is provided so that the outlet of compressed air tank can be connected to the Compressed Air Engine. Fifth, the stiffness of the springs used in the valves was removed.

### VIII. Testing

This paper presents the testing of modified engine. The experimental test conducted on the CAE engine developed in this paper give a practical feasibility of the theoretical concept. The modified engine was tested by using a two-cylinder piston compressor at different values of compressed air pressure.

Table 1: test result

Test	1
Date	06/12/2014
Test condition	<ul style="list-style-type: none"> <li>• Inlet compressed air pressure: 150 psi</li> <li>• No coolant was used.</li> <li>• No engine oil was used.</li> <li>• No spark plug was used.</li> <li>• Engine was manually started</li> </ul>

	<ul style="list-style-type: none"> <li>• Normal weather conditions</li> </ul>
Modification	No modification
Results	Engine just took only one stroke and stopped automatically

Table 2: test result

Test	2
Date	06/18/2014
Test condition	<ul style="list-style-type: none"> <li>• Inlet compressed air pressure: 150 psi</li> <li>• No coolant was used.</li> <li>• No engine oil was used.</li> <li>• No spark plug was used.</li> <li>• Engine was manually started</li> <li>• Normal weather conditions</li> </ul>
Modification	Inlet and outlet valve was modified by reducing the stiffness of the inlet and outlet valve spring
Results	<ul style="list-style-type: none"> <li>• Cool air was coming at the exhaust outlet</li> <li>• Engine was started and was running successfully</li> </ul>

Table 3: test result

Test	3
Date	06/23/2014
Test condition	<ul style="list-style-type: none"> <li>• Inlet compressed air pressure: 120 psi</li> <li>• No coolant was used.</li> <li>• No engine oil was used.</li> <li>• No spark plug was used.</li> <li>• Engine was manually started</li> <li>• Normal weather conditions</li> </ul>
Modification	The Compressed air pressure was reduced from 150 psi to 120 psi
Results	<ul style="list-style-type: none"> <li>• Cool air was coming at the exhaust outlet</li> <li>• Engine was running successfully</li> </ul>

The experimental results conclude that the 4-stroke engine was successfully modified to 2-stroke engine and the engine was running perfectly on Compressed Air.

### IX. Advantages of CAE

This paper discusses the advantages of CAE and give an overview on CAE future development. According to Brown, Atluri, &Schmiedeler (2014), “Compressed air energy storage(CAES) system are one potential alternative to battery-electric system due to their high-power density, low cost, and minimal environmental impact”(p. 477). Thus, theuse of CAE can provide an alternative to electric cars. The experiment shows that there is no emission of pollutant particle from the engine exhaust. As CAE

includes no burning of fuel there is no conversion air molecules into other molecular structure (Mishra & Sugandh, 2014, p. 99). Hence, CAE stand out to be an eco-friendly engine with zero emission. Also, the fuel used in CAE is compressed form of natural air, which is used to power the engine and emitted in same natural form, so there is no depletion in the source of fuel. Further, it was found in the above experiment that a CAE does not require any coolant. Since there is no combustion taking place inside the CAE, a CAE does not require to be cooled to maintain its structural strength. A CAE is very simple in its working process, this means it does not require a complex arrangement of spark plugs, cooling system, and turbos. Thus, a CAE has less costly parts compared to an internal combustion engine. Further, it was found in experiment that the exhaust air coming out of the engine was cooler. This means the cool air coming out from the CAE can be used to chill the passenger compartment of the car. The CAE engine is also cheaper in running. A CAE only uses natural air as a fuel which is free and abundant in nature. The money required in running the engine is for compressing the air, which is a cheap process. Thus, a CAE is very advantageous in use.

The initial design of CAE shows positive results in the development of CAE based car. However, it needs several improvements in its design to catch up with current market requirements. According to Zang, Liu, Li, & Wu (2013) "Compressed air usage, shortage, leakage, and efficiency are several factors that influence the efficiency of a compressed air system" (p. 52). Therefore, an overview of the proposed future design of CAE is presented. The cylinders of the CAE will be surrounded by electronic heating filaments. The heating filament will produce more expansion in the cylinder which will generate high pressure and increase the efficiency of the engine. Also, the exhaust air will pass through the turbo which will rotate the impeller shaft inside it which is connected to the alternator at the other end. This technique is used to generate electricity from waste exhaust air. Further, this exhaust will be used for air conditioning and as an inter-cooler into the compression cycle. The batteries charged from the turbo and flywheel will be used to drive the compressor, this will help in generating on-board compressed air to fuel the engine. A compact and high pressure holding carbon fiber compressed air tank will be used which will provide high strength to the compressed air tank and at the same time lighter in weight. A Multi-cylinder Compressed Air Engine will be also introduced, which can generate more power for heavy duty work.

## **X. Conclusion**

The paper presents the theoretical concept of designing an engine which can run on compressed air technology. Here the theoretical concept was also experimentally proved by modifying a 4-stroke engine into a 2-stroke engine and running the engine by proposed compressed air. Further the experimental result was presented which showed the advantages of using CAE. Thus, CAE gives a possibility to use the unlimited resource of air as a fuel to run the engine. The proposed concept design of CAE helps in solving the problem using a fuel which is renewable and at the same time cheaper in use. The paper also presents an overview on the proposed future development of engine for making it more efficient for public use.

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# E governance for Regional Transport Offices in India

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**Abstract** – India had cross population of 1.3 billion and is 2nd largest country after china. India is having almost 17% of world population. The population density in India is 452 per Km<sup>2</sup>[1]. Even whole country is divided based on different language, different terrain, different rituals, different regions and other parameters. India consist of total 28 states and 7 union territories. Efficient governance in such huge country with different diversity is very difficult task. Government of India is aggressively using Information and Communication Technology (ICT) to provide good governance. By using various methods, tools and technology for E Governance application, government is providing effective service to every citizen at their doorsteps. Transportation is one of the major concern for large country like India. People of India is every year purchasing high numbers of cars, motorcycles, Scooters like personal vehicle as well as very high number of vehicles are purchased for mass transportation and good transportation. Registration of all such vehicles are done through Regional Transport Offices (RTO) situated in all states and union territories. Purpose of this paper is to examine e governance implementation for RTO offices across India.

**Index Terms**- e governance, RTO, Regional Transport Office, RTA, Regional Transport Authority, challenges in e governance implementation, NeGP, Vehicle database

## I. INTRODUCTION

Since few decade, use of Information and Communication Technology is increasing exponentially. Every governments are aggressively using information and communication technologies in their everyday work. Due to that, the study of e-government evolved and different methods to describe e-government and develop digital government research have been advanced.[2][3]. Sometimes terms “E-Governance” and “E Government” is used in place of each other, but actually, E Government is just as subset of E-Governance. We can even define that E-Government is an application of E-Governance. This uses the latest technologies of information and communication technology (ICT) and to make government more efficient, effective and to provide transparent services[4]. The major demand on

government is that it should be fully accessible to cater all requirement of citizens promptly, without wasting time. 365 x 24 x 7 access is expected by citizen for many government work. This can be achieved through E-Governance only. The evolution of e-government initiatives in terms of their degree of technological and organizational sophistication can describe e governance easily.[2][3][5].

E-Government is a small discipline which deals with the expansion of online government services to the citizen and businesses such as e-tax, e-transportation, e-procurement, e-participation etc. E-Governance is a broader thing that deals with the whole range of the relationship and networks within governments regarding the usage and application of ICT for benefit of citizen. The “E” part of both e-government and e-governance stands for the electronic platform or infrastructure that enables and supports the networking of public policy development and deployment.

## II. DEFINITION OF E-GOVERNANCE :

There is no single definition is accepted for E governance. Many governments, organizations or researchers are defining ‘E-Governance’ as per their goals and purposes.

As per UNESCO’[6] E-Governance is “*Governance refers to the exercise of political, economic and administrative authority in the management of a country’s affairs, including citizens’ articulation of their interests and exercise of their legal rights and obligations. E-Governance may be understood as the performance of this governance via the electronic medium in order to facilitate an efficient, speedy and transparent process of disseminating information to the public, and other agencies, and for performing government administration activities.*”

E-Governance defined by ‘The Council of Europe’[7] :

“*The use of electronic technologies in three areas of public action:*

- *Relations between the public authorities and civil*

society

- *Functioning of the public authorities at all stages of the democratic process (electronic democracy)*
- *The provision of public services (electronic public services)”*

As per this definition, the emphasis is on use of electronic technologies with a view to improve interaction between government and citizens and provide public services.

E-Governance is define by Word Bank as[8] “*E-Government refers to the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth, and/ or cost reductions.*”

We know that usage of ICT is surely giving lots of advantages for E Governance. Various researcher had recognized many advantages of E-Governance.[9][5][10][11],

- Improve citizen involvement in government process
- E governance is giving transparency in system which build trust between citizens and government by improving government image in citizens’ mindset.
- Reduction in cost by providing online solution. This reduction in cost is applicable to both Government and Citizen.
- E-Governance services can reach easily in remote areas by use of technology and it is faster.
- Better and more efficient service delivery by Government.
- Citizen is having access to all information online so having insight in government policies.
- Service reaches to citizen rather citizen reach for service.
- Citizen can avail all information of Government through a single window at any time and any location with a device having Internet connection.

- Increase accountability and transparency of government.
- Online process of e governance decrease corruption in many places.
- More efficient and convenience way of utilizing government services.
- Eliminate human errors in the manual process.

### III. EVOLUTION OF E-GOVERNANCE IN INDIA

All over the world, their government had started usage of E Governance at various stages. In India, usage of computers was started just after independence.

Evolution of E-Governance in India can be considered in three phases[12]

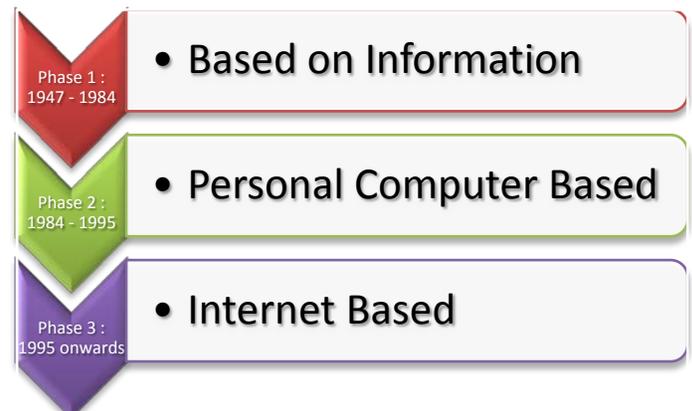


Figure 1 Phases of E Governance in India

- Phase I: 1947-1984 Information based E-Governance
- Phase II: 1984-1995 Personal Computer based E-Governance
- Phase III: 1995-onwards Internet based E-Governance

During all above three phases there are many significant decision were taken, which can be considered as a milestone for e governance evolution.

Whole e governance can be thought initiated in 1950s, where computer is required to use for National Level Planning.

Bhabha committee was formulated for identifying scope and requirement of electronics development in India. 1966. Bhabha Committee recommend requirement of establishment of Department of Electronics (DoE) to support electronics and computer industry.



Figure 2 Evolution of e governance in India

One of the bigger milestone was the establishment of the National Informatics centre (NIC) in 1977 under Department of Electronics. Currently NIC is providing whole backbone for E Governance in India.

Establishment of Computer Maintenance Corporation (CMC) in 1975 was another milestone for E-Governance in India.

In 1984, another major milestone in evolution of E governance in India was happen. A new IT policy introduced in 1984 through which 100% growth in number of computers in India at 50% reduced cost happened.[13].

In 1987, National Informatics Center Network (NICNET) was launched. This was used for providing backbone of Network across India. After NICNET, District Information System of the National Informatics Centre (DISNIC) was introduced, which is to connect all district offices. This DISNIC was working by providing hardware and software to government offices so all can take part in E-Governance initiative.

A National Task Force on Information Technology and Software Development was constituted in May 1998[14].

Indian Government had recognized 12 point minimum agenda for deploying E-Governance in 2000. This was accepted by all union Ministries / Departments.[15].

2008 was one of the major milestone in Indian E governance effort. Department of Electronics and Information Technology (DEITY) and Department of Administrative Reforms & Public Grievances (DAR&PG) had formulated National E-Governance Plan (NeGP) based on which all recent e governance implementation started.

This National E-Governance Plan (NeGP) was comprising of 27 Mission Mode Projects (MMPs) and 10 components which was approved by The Union Government on May 18, 2006.

#### IV. FOUR PILLARS OF E GOVERNANCE

They are listed as under.

- State Wide Area Network (SWAN)
- State Data Centre (SDC)
- Common Service Centre (CSC)
- Service Delivery Gateway (SDG)

For implementation of e governance basic requirement is infrastructure. As per our NeGP, government has decided 4 infrastructural pillars for implementation of e governance.

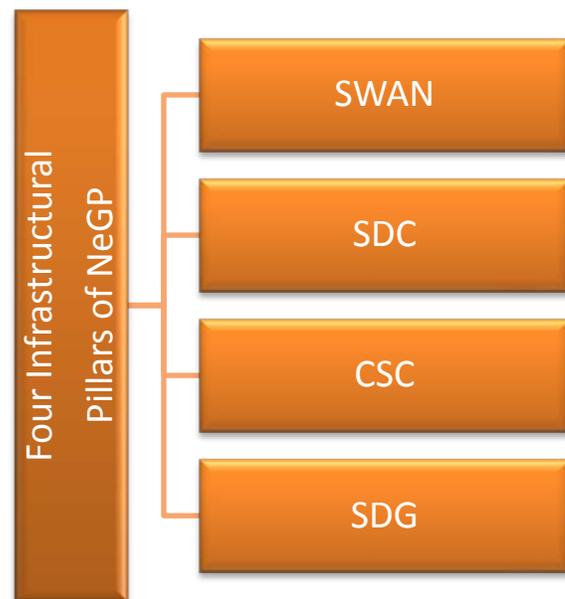


Figure 3 Infrastructural pillars of E Governance

**SWAN** :Government has sanctioned the State Wide Area Networks (SWANs) implementation across the country, in March, 2005 at a total expenditure of Rs.3,334 crore to be given by the Department over a period of five years. Under this Scheme, technical and financial help will be provided to the all States/Union Territories (UTs) for establishing SWANs to connect all State/UT Headquarters, District Headquarters and Block Headquarter, in a hierarchical structure with a minimum bandwidth capacity of 2 Mbps per link. Each of the State / UT can enhance the bandwidth up to 34 Mbps between SHQ and DHQ and up to 8 Mbps between DHQ and BHQ depending upon the utilization[16].

**SDC** :State Data Centres are defined so that every state can consolidate services, applications and infrastructure to provide efficient electronic delivery of Government to Government (G2G), Government to Citizen (G2C) and Government to Business (G2B) services. State Data Centre would provide many functionalities [17].

- Central Repository of the State
- Secure Data Storage
- Citizen Information/Services Portal
- Remote Management
- Disaster Recovery
- Online Delivery of Services
- State Intranet Portal etc..

**CSC** :Large population of India is living in rural area only. Government can develop applications providing E Governance

services, Internet can be avail to every village/ nearby area using SWAN, but government can not force each and every person living in India to use personal Internet access. This is basic reason for approving Common Services Centres. A main use of CSCs is that it will offer services in rural areas, including application forms, certificates, and utility payments such as electricity, telephone and water bills etc...

**SDC** :Various Local, State and Central government had started to implementation of e governance applications. All government systems are using different platform and technologies for E Governance solutions, and it is very difficult to make interoperability between these heterogeneous platforms. This is the reason for implementing various Service Delivery gateways (SDG), which will work as standards based messaging switch between various heterogeneous applications and providing seamless interoperability and sharing of data across different government applications. [18].

## V. E GOVERNANCE IN REGIONAL TRANSPORT OFFICE

India is developing country. Country like India, where huge population is leaving, and transportation is one of the major concern. Approximately 155 million two wheeler, 29 million car, jeep or taxis, 2 million buses and 16 million other vehicle like tractor, three wheeler were registered in 2015- 16[19]. Even approximately 21 million other vehicles were registered in 2016 – 17. Registration of all such vehicles and record of all these vehicles are taken care by Regional Transport Offices (RTO). This work is govern by Ministry of Road Transport and Highway.

For smoother conduction of work, Ministry of Road Transport and Highway had divided work among various States and Union Territories. All vehicle purchased are given unique number and record is maintained with all vehicle identification like engine number, chassis number, type of vehicle, fuel used in vehicle, owner of vehicle etc. For maintaining all such records, task is divided among different states and union territories. To identify vehicle, each state or union territory has unique series. All different series can be found from below figure. We can see list of 29 States and 7 Union territories in below mention figure. Each state and union territories are having many Regional Transport Office. Vehicle related all work is distributed among all these RTO as per region/districts such that all such offices can work properly and citizen can be served better.

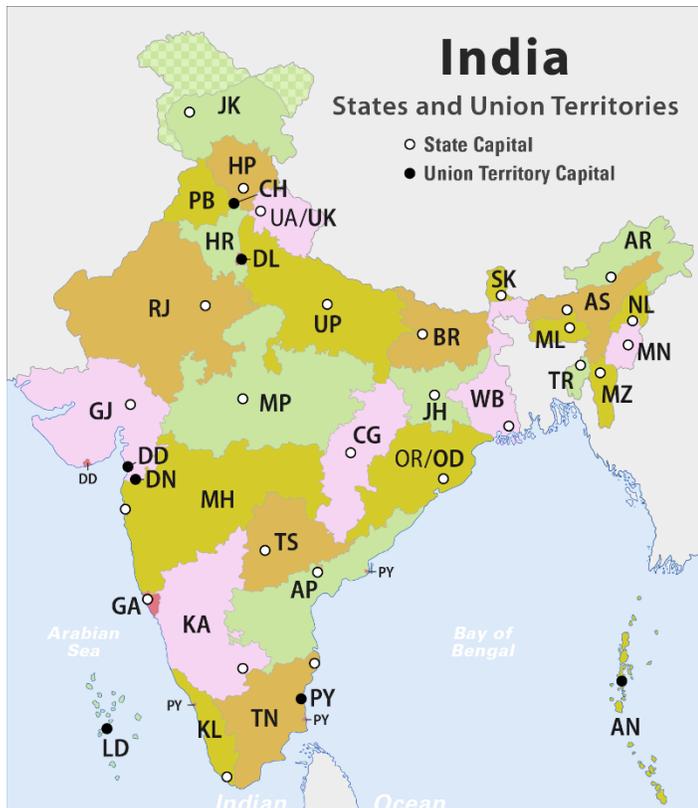


Figure 4 Unique identifier of vehicle series in States and UT [20]

Below mention table consisting list of all State and Union Territory in ascending order with RTO series.[21][22]

S.NO	State/ UT	R.T.O. Series
1	Andaman & Nicobar	AN-01 to AN-02
2	Andhra Pradesh	AP-01 to AP-37
3	Arunachal Pradesh	AR-01 to AR-20
4	Assam	AS-01 to AS-28
5	Bihar	BR-01 to BR-56
6	Chandigarh	CH-01
7	Chhattisgarh	CG-01 to CG- 30
8	Dadra and Nagar Haveli	DN-09
9	Daman and Diu	DD-03 & DD-02
10	Delhi	DL-1 to DL-13
11	Goa	GA-01 to GA- 12
12	Gujarat	GJ-01 to GJ-38
13	Haryana	HR-01 to HR-88
14	Himachal Pradesh	HP-01 to HP-86
15	Jammu and Kashmir	JK-01 to JK-22
16	Jharkhand	JH-01 to JH-24
17	Karnataka	KA-01 to KA-57
18	Kerala	KL-01 to KL-73
19	Lakshadweep	LD-01 to LD-09
20	Madhya Pradesh	MP-01 to MP-70
21	Maharashtra	MH-01 to MH-62

22	Manipur	MN-01 to MN-07
23	Meghalaya	ML-01 to ML-10
24	Mizoram	MZ-01 to MZ-08
25	Nagaland	NL-01 to NL-08
26	Orissa	OD-01 to OD-35
27	Pondicherry	PY-01 to PY-05
28	Punjab	PB-01 to PB-77
29	Rajasthan	RJ-01 to RJ-51
30	Sikkim	SK-01 to SK-04
31	Tamil Nadu	TN-01 to TN-99
32	Telangana	TS-01 to TS-36
33	Tripura	TR-01 to TR-08
34	Uttar Pradesh	UP-11 to UP-96
35	Uttaranchal	UK-01 to UK-18
36	West Bengal	WB-01 to WB-96

Table 1 List of RTO in States and UTs

#### Different activities performed by RTOs

- Issue of Learner's License to drive a motor vehicle.
- Issue of permanent License to drive a motor vehicle and renew the same.
- Issue Badges to the drivers of Public Service Vehicles like Auto rickshaw, Taxis etc
- Issue International Driving Permits.
- Motor Vehicles registration.
- Grant Certificate of Fitness to transport vehicles.
- Inspect private vehicles which are more than 15 years old and renew the registration.
- Issue Permits to Transport Vehicles.
- Issue of authorizations and permits for National Permit Vehicles.
- Issue authorizations and permits for All India Tourist Cabs and Buses.
- Ensure that the motor vehicles are covered by valid certificates of insurance
- Take action on vehicle owners not complying with the provisions of the Motor Vehicles Act and the Tax Act.
- Levy and collect Motor Vehicles Tax as provided under the Bombay Motor Vehicles Tax Act, 1958 and enforce the related provisions.
- Prepare and up-date office record pertaining to all the above activities.

For performing above activities, every citizen need to go physically. Huge number of people visit RTO Offices per year for various purposes as mentioned above. RTO is one of such offices of the Government which is having a huge public interface. Amont them, mostly young people who visit Government office for the first time. Now many states have started using ICT and online implementation of various RTO activities. Prior to this e governance implementation, people were served on first come first serve basis every day from 10 am to 7 pm and applicants used to stand in queue every day from 7 am itself so that they could avail services at earliest.

#### E Governance Implementation in various states for RTO

Gujarat	Rtogujarat.gov.in
Assam	https://vahan.as.nic.in/srsvices/

Jharkhand	<a href="https://vahan.jhr.nic.in/jh/">https://vahan.jhr.nic.in/jh/</a> <a href="https://vahan.jhr.nic.in/SRReports/">https://vahan.jhr.nic.in/SRReports/</a>
Maharashtra	<a href="https://transport.maharashtra.gov.in/">https://transport.maharashtra.gov.in/</a>
Odisha	<a href="https://vahan.ori.nic.in/epermit/">https://vahan.ori.nic.in/epermit/</a> <a href="https://vahan.ori.nic.in/srservices/">https://vahan.ori.nic.in/srservices/</a> <a href="https://vahan.ori.nic.in/echallan/">https://vahan.ori.nic.in/echallan/</a>
Haryana	<a href="https://haryanatransport.gov.in/srservices/">https://haryanatransport.gov.in/srservices/</a>

Table 2 Examples of RTO e governance implementation in few states

Above table is example where different states have implemented various e governance facilities for RTO related tasks.

## VI. SUMMARY

Author had studied implementation different software developed and maintained by different states for doing RTO activities. By using these portals, these states are serving citizen of their respective state so that they can have benefit of e governance implementation and they don't need to wait in long queue at RTO office. As per our study, different state had implement e governance in RTO offices as per their own analysis. Online portal implementation is done by hiring any third party professional company by every states. Due to this differences, there is no common solution is available nation wide for e governance implementation for RTO. In place of it, if implementation is defined and designed nation wide than government can define common way of implementation of e governance services which can be used by all citizen of India. Advantages of common implementation is that only one portal having common User Interface which can be available in vernacular languages is used for e governance in RTO. This solution saves time and cost of analysis and implementation for every states.

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# Housing Renewal Concept of Darmokali Kampung to Support Waterfront Tourism with Sustainable Development Approach

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**Abstract-** Surabaya government policy has mentioned that kalimas river will be developed into a tourism area based on waterfront city. In this case, in the west of the river kalimas very close to the settlements of residents, at least 5 meters from the foot of the river has been found house residents. This is certainly very potential to be developed into a tourism kampung. Therefore this study is aimed to formulate the strategy of housing renewal to support Surabaya sustainable tourism. The method used in this research is quantitative and qualitative with interview technique, quisionare, observation, survey and documentation. So that the concept of urban housing renewal is made to support waterfront city tourism with sustainable approach is semi permanent house redevelopment, RTH arrangement, additional street, arrangement of street furniture, conditioning of clothesline and baggage, public spot and dock facility, kampung entrance and tourism facility, making thematic souvenir, Community Besed Tourism.

**Index Terms-** Housing Renewal; kampung tourism; sustainable development

## I. INTRODUCTION

Indonesia is a country that has a wide range of potential nature, art and culture. The potentials must be developed in order to bring a positive impact for the tourism industry in Indonesia (Hidayah, 2013). So it is must that the government (UU No. 10 of 2009 on tourism) began promoting tourism development programs in various regions as well as placing it as an alternative development approach aimed at promoting economic growth, improving people's welfare, eradicating poverty and overcoming unemployment.

Surabaya government policy that is in UP VII Wonokromo has mentioned that kalimas river will be developed into a tourism area based on waterfront city. In west of the Kalimas river there is a residential community that is five meters from the foot of the river where the settlement is good in that infrastructure. This is certainly very potential to be developed into a tourism kampung. Utilization of potential area for tourism activities should be managed wisely and responsibly and really consider environmental sustainability (Kosmaryandi, et al, 2004).

Sustainable development is a concept that is perceived as appropriate to maintain sustainability which is not only environmentally, but economically, socially and culturally. With the concept of sustainable a great opportunity to support economic development, structuring and environmental services, equality of social and life quality. On the other hand, the concept of sustainability can also reduce the risks of problems caused by population growth, urbanization, slums, poverty, climate change, lack of access to sustainable energy, and economic uncertainty (UN-HABITAT, 2012).. Especially if the direction forward in this kampung is as a tourism kampung. This study aims to formulate the concept of housing renewal to support tourism in Kalimas river Surabaya. This is important for the study because if the development of tourism is not accompanied by efforts to housing renewal in order to changes in function and increase in activity there will be a decline in the quality of both the environment, economic, social and culture (Sihono, 2003).

## II. LITERATURE REVIEW

### **Kampung Tourism**

*Kampung* tourism is a form of integration between attractions, accommodation and supporting facilities presented in a community life structure united in the prevailing ways and traditions (Nuryanti, 1993). According to Hidayat (2014), the tourism kampung program established directly by the government has been able to involve the community in tourism activities. *Kampung* Tourism provides freedom for the community to manage their homeland in accordance with the authenticity of his *kampung*. This is in accordance with the UU No. 10 of 2009 on Tourism Article 4 (a, b, c, d, e, f,) that tourism aims to promote economic growth; Improve the welfare of the people; Eradicate poverty; making out unemployment; Conserve nature, environment, and resources; Advancing culture. Some experts have classified the core components that make up the tourism area. (Director General of Tourism;). Mason and Poerwanto in (Sulistiyowati, 2015) said that the components of the tourism area consists of:

1. Attractions, consisting of tourism objects (both natural or man-made) and event attractions.
2. Amenities, including many accommodation facilities, such as services and receptions, finance, personal insurance, health salon, police, fire brigade, travel, or transportation. This section also covers basic infrastructure.

3. Accessibility, in the form of access to affordable, practical, and easy travel destinations.
4. Tourism organizations, the establishment of organizations that organize and manage all tourism activities, including advertise tourism attractions.

### **Housing Renewal**

In supporting the tourism kampung is necessary to attempt to housing renewal. Couch (1990) said that urban housing renewal is a process of physical change, change of function, and the process of changing the intensity of the use of a land and building as an effort to improve the quality of social economy of the city. Sujarto (2002) states that urban housing renewal is implemented as an effort to renew the life order of society, thoroughly concerning the improvement of behavior, life pattern, and urban way of life through a reform of the city's social, economic and environmental order of the city. So urban housing renewal effort does not dwell on the handling of slums, but in an effort to anticipate the slum is important to be done as an effort to improve the quality of human life.

### **Sustainable Development**

In the process of Urban Housing Renewal, efforts are needed to maintain the sustainability of the settlements, because if not designed with attention to the context of efficiency and sustainability, then the development process will only be a new burden to the environment and climate, because it will only be an act of economic waste and bad. In addition, if large-scale renovations are undertaken without regard to sustainable principles, the results will still not be able to reduce the environmental footprint of existing settlements (UN-HABITAT, 2012).

Based on UN-HABITAT (2012), sustainable urban renewal factors in the environmental dimension, include: (a) Energy efficiency, water and other efficiency resources; (b) Eco-friendly design, using local materials and construction; (c) Sanitation and prevention of disasters and pollution from materials; (d) the use of affordable resources; (e) enhancing resilience and adaptation to occupancy. Economic dimensions, several factors to consider are (a) ensuring housing affordability for different social groups, (b) providing adequate housing to increase labor productivity, ensuring housing integrated with the workplace, (c) supporting domestic economic activity And the company, can (d) promote landlords and self-help housing, (e) housing and maintenance management, and may (f) strengthen the resilience of future homes. When viewed from a social dimension, urban rejuvenation should be able to (a) empower and ensure community participation, (b) ensure the health, safety and well-being of housing, (c) create a sense of community togetherness, a sense of belonging to the environment and identity in the environment (D) find specific needs and wants, including those related to gender, age, and health conditions, and (e) provide access to infrastructure and public spaces. Cultural dimension, states that a sustainable urban rejuvenation is (a) Planning and design of houses and housing should be responsive to culture, may (b) enhance aesthetics, diversity and cultural awareness of the environment and housing; Can (c) accommodate the creativity of the community (eg through facilities, affordable fitness activities, or cultural and entertainment facilities); And may (d) assist the change of communities from kampungs and slums to adequate housing or housing for some families.

## **III. METHOD**

The method used in this research is qualitative quantitative. Data collection techniques are conducted by interview, observation, survey, documentation and the distribution of questionnaires. Questionnaires were distributed to all residents who owned a house by the river which had a river-oriented house of 50 families.

## **IV. RESULT AND DISCUSSION**

### **Location**

The location is located in *kampung* darmokali subdistrict Wonokromo Surabaya precisely on the road darmorejo IV-A and the selected house is a house that has orientation facing the river. In figure 1. House with red notation is the location of the house and its environment will be renewal.



Figure 1. Location of Housing Renewal (Source: author).

### Surabaya Policy review

*Kampung Darmokali* is a *kampung* that is included in the Development Unit/ *Unit Pengembangan* (UP) VII Wonokromo. In it is explained that this *kampung* is included in the area of priority SBWP in the area of UP wonokromo which the development direction is as follows:

1. There are city-level trade and service activities, density and high density settlements, Surabaya Zoo tourism, military area, and transportation support facilities
2. It is a trading and service area, settlement, tourism, transportation support, and military and is the center of UP growth
3. It is the economic center of the region dominated by trade and services and has a great opportunity to increase service scale. Environmental conditions are good
4. Direction of building intensity policy indicates the potential to be further developed
5. Arranged as a growth center, special areas of defense and security, tourism areas, and supporting areas of transportation systems

Based on the Regulation of the Minister of Public Works and Public Housing on Stipulation of River Borders and the Lake Border Line, kalimas river is a river that has embankments so that the border line is at least 3 (three) meters from the outer edge of the embankment River channel. The settlement at *kampung darmokali* is about 5 meters from the outer edge of the river dike. The border of darmokali *kampung* which is the area of SUB UP VII-C Block VII-C2 is used as green line and park, so the direction of its utilization is

1. Prohibit the establishment of permanent buildings for residential and business premises
2. Utilizing the border of Surabaya river bas green line green space
3. Utilizing Kalimas border as a tourism area

In the UP it has been explained that along the river kalimas will be developed as a tourism with the concept of waterfront city, so *kampung darmokali* included in the development area.

### Existing Condition

#### a) Environment Aspect

Kalimas river condition already has a dike. The depth of river according to data from *Perum Jasa Tirta* is between 1 m - 3 m. While the water depth between 1 m - 2 m at sea tide. The typology of *kampung* is housing, street, 2 m river border, dike and river.

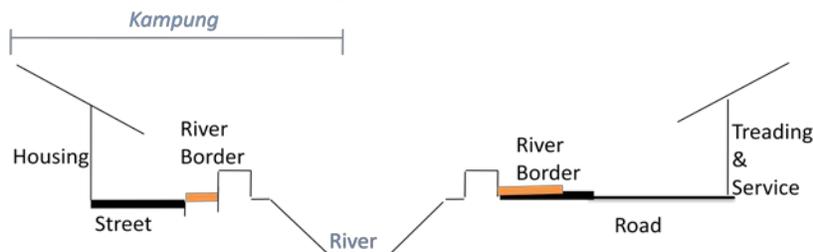


Figure 2. Typology of Kampung (Source: author).

Utilization of river open space as park, seating, parking, street vendors, storage of home furnishings. Housing condition in this *kampung* 80% permanen housing and 20% semi permanent housing. 90% Drinking Water Channels already use their own PDAM, water channels for bathing and washing 85% already use own PDAM, 95% use private bathroom, 95% power lines have got stream from PLN and own property, drainage sewer from bathroom and kitchen 98% permanent standart, 80% permanent rainwater drainage

standard, the rest is not permanent and some even do not have the channel, 60% Septic tank home use septic tank standard, 30% septic tank without recharge, others there is no septic tank.

b) Economy Aspect

Type of work in this *kampung* is 17 formal jobs, 33 privat employments, 24 informal works, 14 entrepreneurs, and 38 housewives. There are many street vendors who sell food such as rujak, soup and so forth. There are many home based enterprises including home-grocery stores, flag-raising businesses, and others. On other hand, there is owned enterprise kampong/ *Badan Usaha Milik Daerah* (BUMD). Land status of community is 4 certified property rights, 20 building rights, 25 state land without a certificates, 1 unclear.

c) Social Aspect

There are many community activity in this *kampung*, that are PKK institution, a citizen cooperative, an arisan activity, a gymnastic activity every week. education average high school, Religion 90% islam, 90% of people live in this *kampung* more than 20 years.

External factor of *kampung* is adjacent to Infrastructure. Recreational facilities: Taman Bungkul, Surabaya Zoo, monument wirasurya agung, monument Surabaya, park jalesveva jayemahe. Trading facilities: DTC Mall Wonokromo, alfamart, indomart, carefour, gas stations, etc. Service facilities: hotel fortuna, novotel Surabaya, grand darmo suite, hotel Malibu, etc. Health facilities: RS. TNI AU Sumitro. Educational facilities: Al-Falah foundation, sunan giri university, yosef santo foundation. Worship facilities: al-falah mosque. Close to the primary artery road that is the road ahmad yani.

d) Culture Aspect

Kalimas River is a river that holds a lot of historical value. There is a bridge that has historical value, where the bridge was built by the Japanese government used to channel fuel to gas stations in the ngagel street. In the area around *kampung*, the architectural style used on average there is a colonial architecture.

## Analysis

In the discussion of this analysis there are 2 aspects that will be discussed that is related to tourism and housing renewal approach with sustainable development.

### Kampung Tourism

Some experts have classified the core components that make up the tourism area.

- a) Attractions, consisting of tourism objects (both natural or man-made) and event attractions. In the context of this darmokali *kampung* river is a potential for the holding of tourism facilities such as rafting or river tour.
- b) Amenities, the number of supporting facilities in the internal and external *kampung* is a potential tourism *kampung*. This *kampung* has many accommodation facilities, such as shops, shops, handicrafts, workshops and so on. External facilities in the vicinity of kampung are not only local but regional and national scale which include health facilities, trade, tourism.
- c) Accessibility, in the form of access to affordable, practical, and easy travel destinations. *Kampung Darmokali* is a *kampung* that has very high accessibility because it is not far from the main artery road of Surabaya city namely Ahmad Yani street.
- d) Tourism organization, in the formation of this *kampung* tourism organization, this *kampung* has a strong social cohesion and has some well-run kampung organizations such as RT, PKK, cooperatives and so forth.

### Sustainable Development

In the discussion of further analysis through a sustainable development approach which will be discussed starting from the environmental, economic, social and cultural aspects

a) Environment Aspect

**Energy efficiency**, water and other efficiency resources; Because these settlements are on the banks of the river it becomes very potential to manage water resources, for example, for household needs or maximize water tourism facilities but there is a river threat to be slum if not managed properly.

**Eco-friendly design, using local materials and construction.** The condition of the house in this *kampung* using the average using local materials other than that seen from the physical condition of the house can be said good because most households have been able to meet the needs of household infrastructure well.

**Sanitation and prevention of disasters and pollution from materials.** Sanitation in this *kampung* is good from the drainage, dirty water, etc.

**The use of affordable resources;** In the use of river RTH used as a park or gathering place but because the land is very narrow house so the people hanging clothes or store household furniture in front of the house and in the river RTH area so it is very disturbing visual and less interesting if used as a tourism *kampung*. These patterns imply that there is a need for society to stay contained such as space for socializing, developing the economy and storing goods.

**Increase resilience and adaptation to occupancy.** There are 5 semi-permanent houses whose land status belongs to the State without a certificate. This is a potential through which intervention from the government can be dimultifungsikan that is used to be a dwelling and also tourism support facilities.

b) Economy Aspect

- o Through government intervention on semi-permanent houses it can ensure housing affordability for different social groups.

- Provide adequate shelter to improve labor productivity, ensure housing is integrated with the workplace. The number of informal workers is a potential in tourism development in the form of labor.
- Support domestic and corporate economic activities. The large number of housewives is a potential *kampung* because IRT is not tied to the work of mothers in this *kampung* can be directed to entrepreneurship in making souvenirs. But the problem is the lack of skills IRT has The potential to develop a culinary tour in this *kampung* is very large seen from the number of home based enterprise and street vendors
- With the existence of BUMD institutions can be a support institution in developing the *kampung* entrepreneurship

c) Social Aspect

With many activities conducted by the community indicates that the relationship between citizens is very strong. This can support the tourism program such as:

- empowering and ensuring community participation in pre-in-post activities of tourism *kampongs*
- Create a sense of community-to-people together, a sense of belonging, and identity within the community so that sustainability is maintained.

In addition to the availability of access to infrastructure and public space it will be very potential to attract many visitors

d) Culture Aspect

- The planning and design of *kampung* tourism must be responsive to the existing culture, especially the historical value of the river kalimas and the culture in the local community
- improving the aesthetics, diversity, and cultural perennialism of the *kampung* by adding architectural elements such as architecture around the *kampung* that is the architecture of the Dutch.
- accommodate the creativity of the community by providing an open space as a gathering place and the development of community creativity.

**Concept**

In realizing the tourism *kampung* that supports the tourism kalimas Surabaya hence required some concepts to maintain the sustainability of the *kampung* are

a) Redevelopment of semi permanent house

The semi-permanent house was built into a two-story house through which the government intervened for land status. So the concept is, The first floor is used as a parking area or street vendors while the second floor is used as a community dwelling. In figure 3. Is the location of semi permanen housing and figure 4 is a concept of redevelopment.



Figure 3. (a) Location of semi permanent house, (b) Redevelopment of semi permanent house (Source: author).

b) Additional Street

The Additional Street is needed given for facilitating tourism. It used as a tourism element such as just enjoy the beauty of the river, fishing and so on. With the construction stage on the additional street will not disrupt the function of the river itself which as a flood controller. Even in the policy direction of the use of border can be done construction of bridge and dock facilities.

In addition, because the river is clean and free of waste, the Government of Surabaya has been filling the river kalimas with various types of fish, so that in the development of tourism can be used as fishing and culinary tourism. Other than that the addition of this road is used to reduce the level of activity density contained in the *kampung* street, so that when many visitors then the community will not lose their privacy. In figure 5, red color is a additional road.



Figure 4. Additional Road (Source: author).

c) River Border Arrangement

Structuring river border is to accommodate existing activities only arranged to be neat and can optimize the potential that exists. The arrangement covered to socialization that accommodate by seat, playground, and gazebo. Selling activity is covered by a street vendor facility. Garden is used to green open space. The arrangement is garden with seat and follow by parking area and than street vendor area that follows by gazebo and playground, and so on.

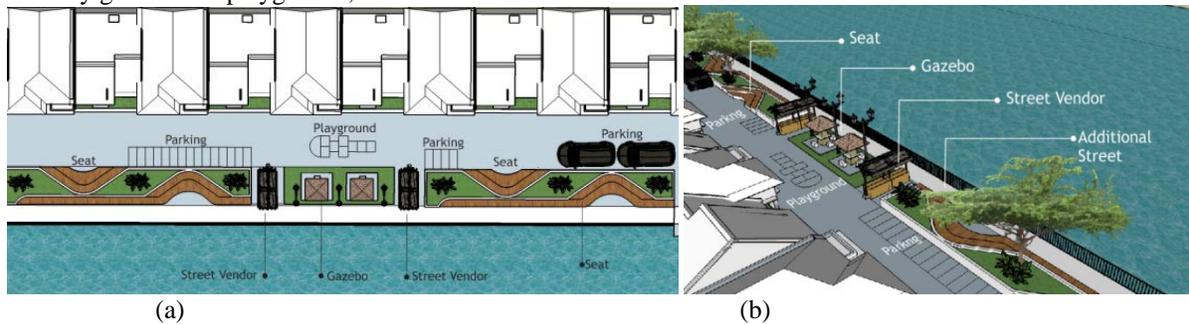


Figure 5. The Arrangement of River Border (Source: author).

d) Street furniture

For development as a tourism place, it takes some elements of street furniture to add beauty *kampung* such as painting *kampung* road, facilitating playground, seat and lamps. This becomes important to do because to increase the aesthetic value of tourism *kampung*.

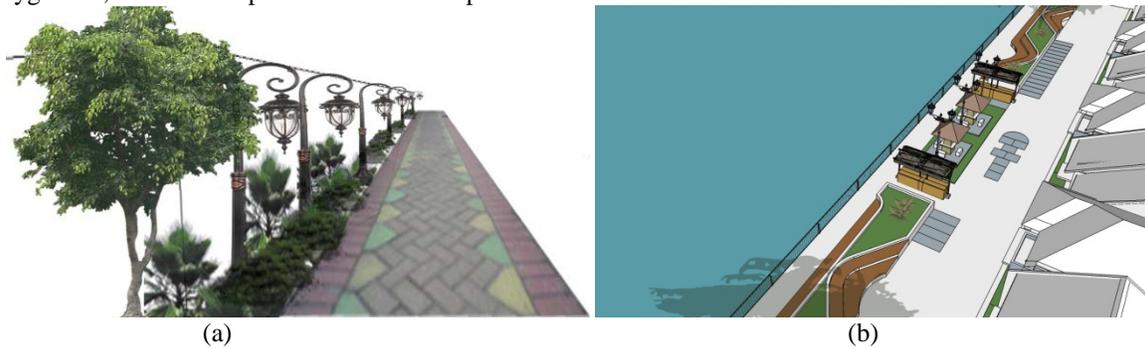


Figure 6. Street Furniture (Source: author).

e) Conditioning Clothesline and baggage of Community

In this village one of the problems is the irregular of the clothesline and the baggage of the community, as shown figure 7 and 8 are clothesline and baggage problem



Figure 7. (a) Clothesline problem, (b) Baggage problem (Source: author).

Clothesline and baggage problem is very disturbing visual if not arranged especially if *kampung* orientation will be used as a tourism attraction therefore visitors should be diverted their interest so that the solution is to give decoration in the form of a shrub garden and placed in front of the house.

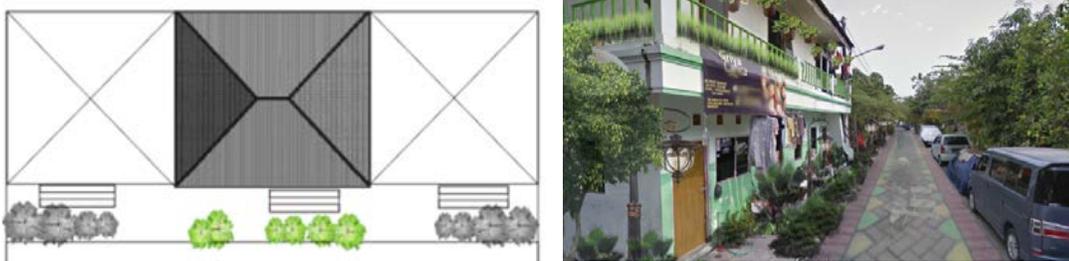


Figure 8. Solution of Clothesline and baggage problem (Source: author).

f) Public Spot and dock

To maximalize of tourism facilities so it is important to establish the public spot area and dock. Consideration in determining the location of public spots and docks is to see from the location of semi permanent houses which will be in redevelopment and the location of the distribution of street vendors. In figure 10, the square is a semi permanent housing location and the black point is a distribution of street vendor

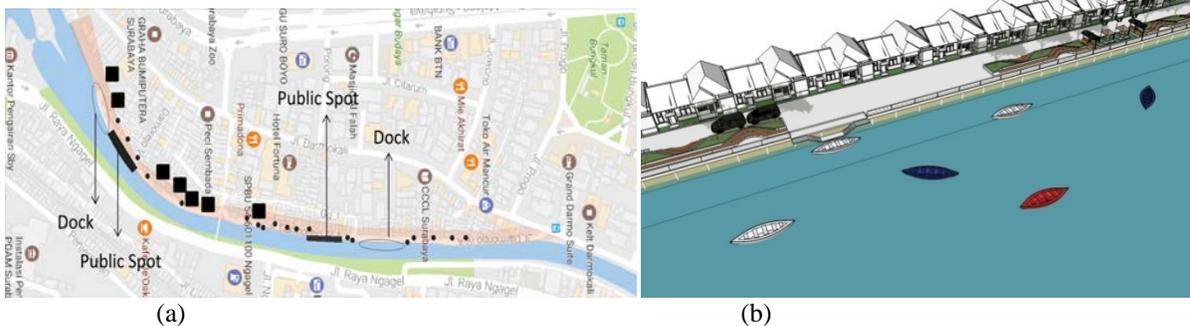
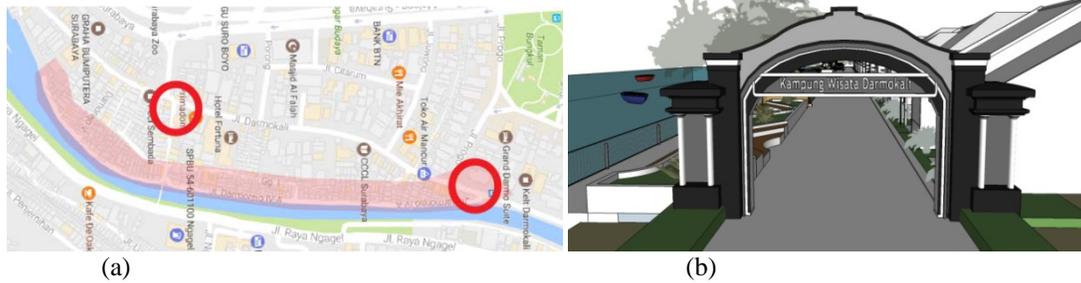


Figure 9. (a) location of Public Spot and Dock, (b) Public Spot and Dock (Source: author).

g) Gate

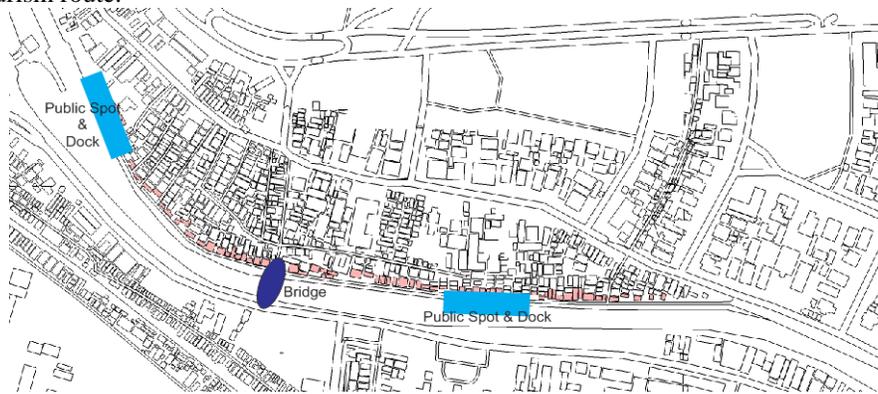
The gate is used as a marker that tourists will enter the tourism *kampung*. In this case because the location is approximately 1 km long and there are 2 access to enter the *kampung* gate is placed in two locations. So that visitors can choose from where he will start the tour.



**Figure 10.** (a) Location of Gate (b) Design of Gate (Source: author).

**h) Tourism facilities**

With the addition of water tourism facilities will increase the attraction of tourists to visit the *kampung*. In this case the river tour can be an alternative solution, because looking across the river kalimas there is also a park (exactly on the ngagel raod) which can also be a tourism attraction. Besides, the blue bridge can be an alternative to the turning point from the park ngagel to *Kampung Darmokali*. Besides other facilities to support a suitable tour in this *kampung* is rafting. In this *kampung* there is a bridge whose position is located in the middle of the *kampung* which passes through the river kalimas. This bridge has its own historical value so it will be very good if included as part of the tourism route.



**Figure 11.** The location of bridge and Public Space & Dock (Source: author).

**i) Community Based Tourism (CBT)**

According to Hausler in Nurhidayati (2013) CBT is a tourism development approach that emphasizes the local community (whether directly involved in the tourism industry or not) in the form of providing opportunities (access) in the management and construction of tourism that led to political empowerment through life more Democratic, is included in the sharing of the benefits of a more fair tourism activity for the local people. Potential relationships between strong residents are very supportive for this CBT implementation. By using CBT it will facilitate in managing tourism because the community is very familiar with the environmental conditions so that efforts in the management of the *kampung* tourism will be optimal. It will be very good if the community is involved starting from pre-in-post development and its management. This will add a sense of belonging to the environment.

Therefore development should be implemented with a bottom up system, which the community will be the subject. While the government and NGOs as a facilitator. In addition to tourism will indirectly touch and involve the community, so it will bring impact on the local community (Pitana, 2005). Many labor opportunities that can be utilized by the population with the existence of this tour either from tourism facilities or entrepreneurship. And one of the positive impacts of tourism activities is to create jobs and spur economic growth (abdurraamad and Maryani, 1998).

**j) Making thematic souvenirs tourism kampung**

The word souvenir is defined as, an object brought home by tourists as a memento for his journey. Souvenirs are often called "souvenirs", "souvenirs", or "pieces of hands" (Dictionary Webster English Dictionary, 2004). Therefore it would be a necessity of a tourism facility to provide souvenirs for tourists. In this case could be typical of Surabaya or thematic tourism *kampung*. Training on entrepreneurship and soft skill is very necessary to support tourism activities, because if it can be maximized it will give reduced operational costs because the community itself is working so that the profits will be greater.

**V. CONCLUSION**

The concept of urban housing renewal is made in realizing the tour of stren times with sustainable approach is semi permanent house redevelopment, RTH arrangement, additional street, arrangement of street furniture, conditioning of clothesline and baggage, public

spot and dock facility, kampung entrance/ gate and tourism facility, making thematic souvenir Tourism kampung, and Community Based Tourism (CBT).

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# Evaluating Parental Screening Tool for Developmental Milestone in Children Under Five Years in Rural Western Kenya

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**Abstract- Background:** An estimated 200 million children suffer from developmental delays, most in developing countries. Early diagnosis through screening is key to timely intervention. However, screening tools have not been assessed in developing countries.

**Objective:** This study therefore assesses parental screening tool for evaluating developmental delays (PEDS; DM) in children under 5 years.

**Method:** Across-sectional survey of randomly selected 870 caregivers to test sensitivity and specificity of developmental domains of children under 5 years was used.

**Results:** Specificity above 89 % was observed in all the developmental domains and Sensitivity above 57% was observed in all the domains except for gross motor that had 35.8%. Negative predictive value was above 90% in all the domains while the positive predictive value was between 18% and 40%. In addition, an average scale reliability coefficient of 8.6 was observed and moderate likelihood ratio LR [5-10] in all the domains except for gross motor which had LR [2 – 5].

**Conclusions:** The PEDS;DM has high specificity and good reliability for all the developmental domains in children under 5 years and therefore it is adequate and can be used by primary health providers for initial testing to detect risk of developmental problems. However, the sensitivity should be improved for all the domains and specificity for gross motor domain.

**Index Terms-** developmental Delay, accuracy, PEDS:DM, Kenya

## I. INTRODUCTION

The mortality of children under five years has significantly reduced in developing countries (1). Certain risk factors that precipitate mortality in children also have a negative impact on their development outcomes. Improvement in child health care does not eliminate these risk factors, these children therefore are faced with a new hurdle to overcome. Consequently, among the surviving, more than 200 million children under five years are suffering from developmental delay (1). The common developmental problems affect the fine motor, gross motor, socio-emotional, self-help, receptive and expressive language(2).

In developed countries, early intervention programs that are cost effective have demonstrated lifelong benefits and increased chance of reversal(3). However, there is need for early identification (before two years of age) of affected children(4). There are a number of standardized developmental screening tools but most of them have not been assessed in developing countries. The few for developing countries have not been assessed in multiple populations. Most of the time, these tools when adapted or developed in developing countries, their use are confined to the research population. Some of these tools require supplies, training and takes a lot of time hence they are rarely used outside research settings(5). A systematic review of 14 developmental screening tools used in low and middle income countries (LMICs) recommended further research and development to optimize the tools(6).

Parental Evaluation for Developmental status: Developmental Milestones (PEDS: DM) is used for screening developmental delay for children from birth to 8 years of age. It consists of 6 to 8 questions per age range(7). It is quick and easy to administer because it is based on caregiver's report. Each item measures one of the eight domains of development including fine motor, gross motor, socio-emotional, self-help, expressive language, receptive language and for older children, reading and math. Each item measures a different developmental domain giving a pass or a fail. The age level are grouped into 1 – 3 months for ages up to 2 years, then 4 to 6 months intervals up to 5.5 years of age(8). It can be administered at ages 9, 18, 24 and 30 months, thereafter it is administered annually up to 8 years. This study therefore sought to assess sensitivity, specificity and reliability of PEDS: DM in comparison to PEDS: DM norming scores in rural western Kenya.

## II. METHODS

**Design:** The design of the study was cross-sectional survey targeting caregivers of at least one child under five years from a given household. PEDS: DM was used as a developmental delay screening tool based on caregiver report.

**Study Site:** The study was conducted in Ugunja sub-location which is located in Western Kenya. It has a population of 12,000; 3466 households and 1708 children under 5 years according to census survey of June 2014 by Ugunja Community and Resource center (UCRC). The site was chosen because the organization (UCRC) has made marked progress in trying to address issues of child development. They have a dedicated database of children under five years and their caregivers and run a community health center and early childhood development center

**Subjects:** The study population was of caregivers of at least one child under age five years from a given household. The details of all households, caregivers, children under 5 years were obtained from UCRC a database updated regularly by Community Health Volunteers (CHVs). The children born preterm or children with birth defects or known developmental disabilities were excluded from the study. Free and informed consent of subjects were obtained and Ethical approval was sought from Moi University/Moi Teaching and Referral hospital Institutional Research Ethics Committee

**Data collection and analyses:** The response options of the domains were 3 scale likert; fine motor (no, sometimes, yes); receptive language and expressive language (none, 1, 2 or more); and socio-emotional (no, often, yes). These responses were ordered into scores 1, 2 and 3. Each child's performance was scored based on their caregivers' response on a question (item) in each developmental domain. A child would perform well in the item if they scored three (3) in expressive and receptive language and socio-emotional items, and two (2) or three(3) in fine and gross motor items.

Because there was no developmental assessment data using a different tool, the PEDS:DM data in each domain was again normalized by age group and sex to provide sample level estimation of grouping of risk of developmental delay. A child was grouped at risk of developmental delay in a domain if their quotient was equal to or below 16<sup>th</sup> percentile of the normalized data. The age group was 3 months grouping between 0 – 59 months.

Data analysis for sensitivity, specificity, positive and negative predictive values was based on the tools scoring ability to predict the sample level norm grouping. Scale reliability of the tool was measured using Cronbach's Alpha.

### III. RESULTS

A total of 870 children were screened of which 460 (52.9%) were female. Median age was 32 months, range (1 – 59 months). Median age of the caregiver was 28 years range (18- 81 years). This information is summarized in table 1.

**Table 1: Demographic characteristics of the study population**

Characteristics	Measurement (N=870)
Child Age (Months)	Median = 32, range(1-59)
Caregiver Age (Years)	Median = 28, range (18 – 81)
Child Sex	
Male	410(47.13%)
Female	460(52.87%)
Number of children in household	Median = 3, range(1-9)
Caregiver years in school	Median = 8, range (0 – 17)

**Specificity and Sensitivity:** Specificity of the tool was high in all the domains; expressive language 89.6%, receptive language 92.3%, fine motor 93.4%, gross motor 89.7% and socio-emotional 89.5%. Sensitivity of the tool was low; expressive language 54.9%, receptive language 75.4%, fine motor 57.8%, gross motor 35.8% and socio- emotional 52.5%. Positive predictive value of the tool was low with wide confidence intervals in all the domains, exhibiting 23% in expressive language, 39% in receptive language, 40% in fine motor, 25% in gross motor and 18% in Socio-emotional. Positive predictive value of the tool was low in all the domains, while Negative predictive value was high exhibiting 97% in expressive language, 98% in receptive language, 96% in fine motor, 93% in gross motor and 97% in Socio-emotional (See table 2).The low sensitivity of the tool in measuring gross motor was attributed to three questions. The questions regarding use of stairs and ladders and walking forward heel to toe. Averagely 22% of the caregivers either refused to answer or were not sure. The distribution of caregiver score to these questions did not match the pattern of the rest of the questions

**Table 2: Specificity, Sensitivity, and predictive values of the PEDS: DM tool**

Domain	Rate (%)	95% CI	
<b>Expressive language</b>			
Sensitivity	54.9	(40.3,	68.9)
Specificity	89.6	(87.3,	91.5)
Positive predictive value	23.9	(16.5,	32.7)
Negative predictive value	97.1	(95.6,	98.1)
<b>Receptive language</b>			
Sensitivity	75.4	(62.2,	85.9)
Specificity	92.3	(90.3,	94.0)
Positive predictive value	39.8	(30.5,	49.7)
Negative predictive value	98.2	(97.1,	99.00)
<b>Fine motor</b>			
Sensitivity	57.8	(44.8,	70.1)
Specificity	93.4	(91.6,	95.0)
Positive predictive value	40.2	(30.1,	51.0)
Negative predictive value	96.7	(95.2,	97.8)
<b>Gross motor</b>			
Sensitivity	35.8	(25.4,	47.2)
Specificity	89.7	(87.4,	91.7)
Positive predictive value	25.4	(17.7,	34.4)
Negative predictive value	93.82	(91.4,	95.0)
<b>Socio-Emotional</b>			
Sensitivity	52.5	(36.1,	68.5)
Specificity	89.5	(87.2,	91.4)
Positive predictive value	18.8	(12.0,	27.2)
Negative predictive value	97.6	(96.3,	98.5)

**Reliability**

Internal scale reliability of the tool when used in this population using Cronbach’s Alpha, gave a scale reliability coefficient of averagely 0.86 for all domains of development (See table 3).

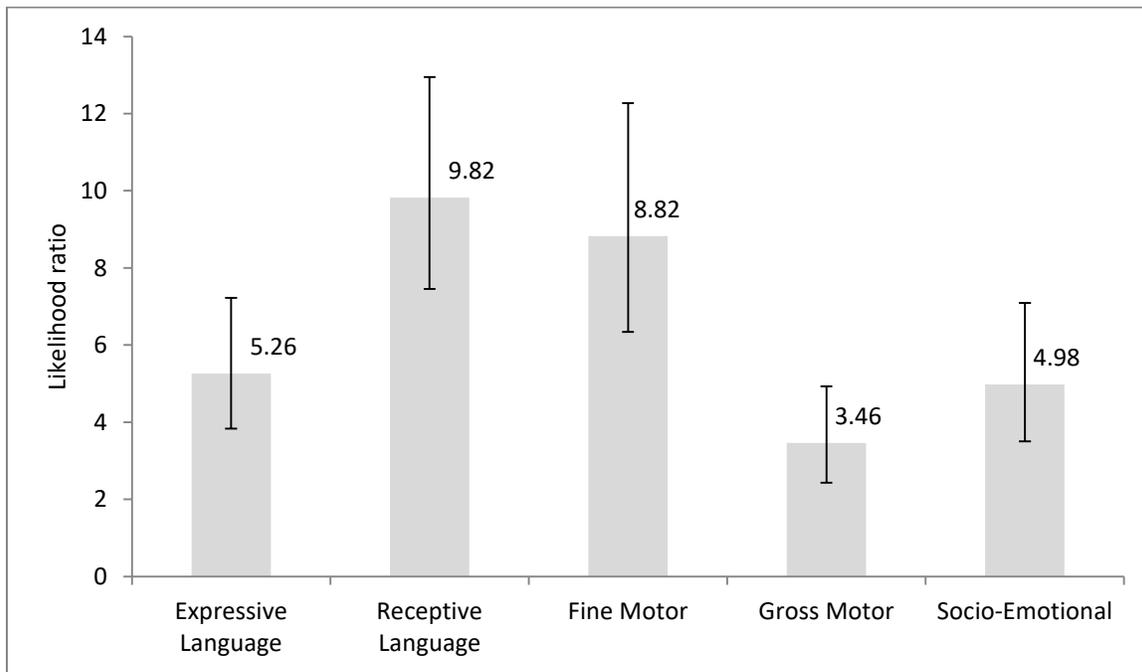
**Table 3: Cronbach’s alpha for internal scale reliability of PEDS:DM per developmental domains**

Domain	Number of items	Cronbach’s Alpha (Scale reliability coefficient)
Expressive language	17	0.87
Receptive language	18	0.86
Fine motor	16	0.86
Gross motor	13	0.82
Socio-emotional	17	0.88

**Positive likelihood ratio**

The probability of disease was increased by moderate units, Likelihood ratio (LR)of between 5 to 10 in all domains except in gross motor, where there was small increase likelihood of disease, LR of between 2-5.The LR in the various domains with 95%

confidence interval was Expressive language had 5.26[3.83,7.22], Receptive Language 9.82[7.45,12.95], Fine Motor 8.82[6.34,12.27], Gross Motor 3.46[2.43,4.93] and Socio-emotional 4.98[3.50,7.09] ( figure 1).



**Figure 1: Positive likelihood ratio with 95% CI of PEDS:DM in measuring risk of development delay in the various developmental domains**

#### IV. DISCUSSIONS

The sensitivity of the tool was consistently 57% or higher in each developmental domain except in gross motor and specificity was consistently 89% or higher. The positive predictive value ranged from 18 – 39% while the negative predictive value ranged from 93-98%. Reliability was above 85% in all domains showing high level reliability of the tool. Although the sensitivity of the tool did not meet the recommended sensitivity of 70% in all domains except receptive language(9) the results shows that the tool is likely to identify higher proportion of children with possible difficulties for further screening but it is not sensitive enough to pick out all children (10). The likelihood ratio confirmed that using the tool increased the probability of identifying children at risk of delay by moderate units which lies between 5 to 10 in all domains except in gross motor.

The pattern of the results seen in this study was also seen in a similar study conducted in Thailand using adapted PEDS:DM(11). These patterns of sensitivity and specificity had also been reported by a study in South Africa when comparing a nationally developed tool to PEDS(12) where sensitivity was lower than 70% but specificity was usually high at above 89% for all domains. Conversely, a study using norming data for developmental milestones from the United States found that PEDS have high sensitivity and specificity often above the recommended sensitivity 70% and Specificity 80%. The negative predictive value and positive predictive value patterns was also consistent with a study(7) that compared the tool with Baileys Scales of Infant Development Second edition which reported low positive predictive value (mean of 50%) and high negative

predictive value (mean of 95%). The study also showed that positive likelihood ratio was averagely 4.5 which compares with the results of this study.

The low sensitivity in gross motor was due to the three questions asking about use of ladders, stairs and walking heel to toe may have included questions of construct validity of the tool (13). This means that the questions may not be interpreted correctly by the caregivers in this setting.

PEDS:DM has high Specificity and good reliability for all the developmental domains in children under 5 years and therefore is adequate as a screening tool to be used by primary health practitioners. However, the sensitivity should be improved for all the domains. This can be done by further research to modify the questions to the rural populations and setting.

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# Evaluations of brinjal germplasm for resistance to fusarium wilt disease

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## Abstract:

Fifty two lines of brinjalgermplas were screened against the in a sick plot for fuarium wilt resistance at Develeela life science Pvt. Ltd., Raipur Chhattisgarh. six lines, viz., AB-2, AB-6, AB-8 , AB-24, AB-35, AB-50 showed highly resistant reaction, with no wilting of plants; five lines, viz., Ab-26, AB-25, AB-52, AB-44 and AB-13, showed resistance reaction per cent wilt 3.33 -10.0. Two line, viz., AB-33 and AB-20, showed moderately resistant reaction, with 11.0 and 12.0 per cent wilt incidence, respectively; while, 25lines were 'moderately susceptible to highly susceptible',with wilt incidence ranging from 25.45 to 100.0%.

**Key words:** Brinjal, Fusarium wilt, resistance screening

## INTRODUCTION

Brinjal (*Solanum melongena* L.) belongs to the family Solanaceae and is the most important and widely-consumed vegetable in India. It is grown in 691,000 hectares with production of eight to nine million tonnes (equivalent to one quarter of global production), which makes India the second largest producer of brinjal in the world. Fusarium wilt, caused by *Fusarium oxysporum*, is a major constraint in brinjal production in India. The disease is widely distributed in tropical, subtropical and some warm temperate regions of the world. The pathogen is difficult to control since it is soil-borne and has a wide host-range, including several hundred species representing 44 families of plants. Infection is through root-to-root transmission, movement of soil and dissemination by farm implements, and insect transmission. A combination of high temperature and poor drainage favour development of the disease which causes 75 to 81% yield loss during summer in India (Das and Chattopadhyay, 1953; Rai *et al*, 1975; Rao *et al*, 1976).Fusarium wilt in brinjal is being managed by application of bactericides, copper fungicides and by crop rotation, with no adequate control. Once the disease develops and wilt symptoms appear in the field, application of bactericides and copper fungicides has no effect on the bacterium. Crop rotation is not a viable control method, as; the bacteria can persist indefinitely in infested fields (Jaworski and Morton, 1964; Sonoda, 1978). In the absence of effective chemicals and bactericides for managing this disease, emphasis is laid on developing brinjal (brinjal) cultivars with resistance to *Fusarium oxysporum*. Though resistance to fusarium wilt has been studied in several crops, especially tomato, there is little published work on fusarium wilt resistance in brinjal (Chaudhary and Sharma, 2000; Zakir Hussain *et al*, 2005; Mondalet *al*, 2013).

## MATERIAL AND METHODS

A total of fifty twobrinjal lines, including resistant and susceptible checks (Table 1), were evaluated during the year 2015-2016 in fusarium-wilt sick plot at Develeela life science Pvt. Ltd., Raipur Chhattisgarh. 35 day old brinjal seedlings of these accessions raised in pro-trays were transplanted to wilt-sick soil which had a pathogen population of 1.0 x 10<sup>6</sup> cfu/gm soil. Infested soil was used because it permits assessment of field resistance by allowing the infection process to take place under natural conditions, with realistic doses of naturally-produced inoculum. Recommended package of practices for growingbrinjal crop were followed from transplanting up to harvest.The fugal, *Fusarium oxysporum*, was isolated from freshlywilted brinjal on Triphenyl Tetrazolium Chloride agarmedium (TTC) (Kelman, 1954) and multiplied on 523enriched medium (Kado and Haskett, 1970). Fusariumsuspension from 523 medium was diluted in sterile distilledwater and its concentration adjusted to 0.3 OD at 600nm(1.0 x 10<sup>6</sup>cfu/ml) using a spectrophotometer. To ensureinfection, the plants were also inoculated with fusariumsuspension (1066cfu/ml) by axil-puncture method at 15 and30 day after transplanting(Winstead and Kelman, 1952;Rashmi *et al*, 2012). All the 41 accessions were replicatedthrice, with 30 plants in each replication, in RandomizedBlock Design. Periodical, observations were recorded on incubation period and per cent fusarium-wilt incidence. Tassess length of the incubation period, an average of 10.0per cent of wilted plants from each accession was taken(Atabug and Juan, 1981) and fusarium infectivity wasconfirmed by

the ooze test, as also by isolating the bacterium on TTC medium. Wilt symptoms and number of wilted plants per accession were recorded and graded on 0-5 scale, as per Winstead and Kelman (1952) and Zakir Hussain *et al* (2005), with some modification. The modified rating scale is given below: 0 - Highly Resistant (HR) with no wilt symptom; 1 Resistant (R), with 1 - 10% wilted plants; 2 - Moderately Resistant (MR) with 11 -20% wilted plants; 3 - Moderately Susceptible (MS), with 21-30% wilted plants; 4 - Susceptible (S) with 31- 40% wilted plants, and, 5 - Highly Susceptible (HS) with > 40% wilted plants. The experimental data were statistically analyzed. Data on per cent incidence of wilt were transformed into arc sine, and analysis of variance was carried out with transformed values. The means were compared for statistical significance using Duncan multiple range test (Panse and Sukhatme, 1989). The accessions were categorized as highly resistant to highly susceptible, depending on the percentage of wilted plants.

## RESULTS AND DISCUSSION

Results presented in Table 1 showed that six lines, viz., AB-2, AB-6, AB-8, AB-24, AB-35, AB-50 showed highly resistant reaction, with no wilting of plants; five lines, viz., AB-26, AB-25, AB-52, AB-44 and AB-13, showed resistance reaction per cent wilt 3.33 -10.0. (Fig. 1), Two line, viz., AB3-3 and AB-20, showed moderately resistant reaction, with 11.0 and 12.0 per cent wilt incidence, respectively; while, 25 lines (Table 1) were 'moderately susceptible to highly susceptible', with wilt incidence ranging from 25.45 to 100.0%.. The resistant check varieties, ArkaKeshav and Arka Nidhi, showed no fusarium wilt incidence, and, the susceptible check, ArkaShirish showed 100% wilt incidence. Similar observation was also made by Chaudhary and Sharma (2000), who found that genotype SM 6-6 to be resistant to fusarium wilt, with ArkaKeshav, ArkaNeelkanth and Arka Nidhi as the resistant checks. Mondal *et al* (2013) found that out of eight lines of local brinjal germplasm screened in fusarium-wilt sick soil, 'Midnapur Local' and 'Bhangar' were tolerant to the disease. Normally, under field conditions, wilt symptom appears at the time of flowering, which is approximately 30 to 40 days after transplanting. In the highly-susceptible variety ArkaShirish, the first symptom of wilt appeared after six days from the first inoculation (20.0% wilt), which was 21 days after transplanting and extended for 35 days (100.0% wilt); whereas, in the resistant accession (RES-5 and RES6) which showed wilt incidence of 3.33 to 10.0%, the initial Symptom was noticed 14 days after the first inoculation, and had a longer incubation period of 60 days. Similar observation was made by Rahman *et al* (2011) on incubation of the pathogen in resistant cultivar Katabegun, which showed 30.0% fusarium wilt incidence after 55 days of transplanting to wilt-sick soil. Thus, the present results indicate that resistant accessions had longer incubation period compared to the susceptible ones. Similarly, Rahman (1997) reported in chilli that resistant accessions had a longer incubation period and took a longer time to produce disease symptoms, than the susceptible accessions. Accessions found to be highly resistant in the present study are being further used in breeding programmes for developing fusarium wilt resistant brinjal hybrids.



Fig.1 Fusarium wilt susceptible (A) and B and resistance lines of brinjal (C)

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**Table 1:- Evaluation of eggplant accessions for Fusarium wilt resistance**

S. No	Name of lines	Wilt incidence Mean* (%)	Reaction	S. No	Name of lines	Wilt incidence Mean* (%)	Reaction
1	AB-1	54.44 (47.53)	HS	27	AB-27	100.00 (89.96)	HS
2	AB-2	00.00 (0.00)	HR	28	AB-28	100.00 (89.96)	HS
3	AB-3	60.00 (50.76)	HS	29	AB-29	100.00 (89.96)	HS
4	AB-4	33.33 (35.23)	MS	30	AB-30	100.00 (89.96)	HS
5	AB-5	44.33 (40.48)	HS	31	AB-31	100.00 (89.96)	HS
6	AB-6	00.00 (0.00)	HR	32	AB-32	100.00 (89.96)	HS
7	AB-7	96.66 (79.94)	HS	33	AB-33	12.00 (20.96)	MS
8	AB-8	00.00 (0.00)	R	34	AB-34	75.00 (60.00)	HS
9	AB-9	75.00 (60.00)	HS	35	AB-35	00.00 (0.00)	HR
10	AB-10	96.66 (79.94)	HS	36	AB-36	100.00 (89.96)	HS
11	AB-11	86.55(65.23)	HS	37	AB-37	100.00 (89.96)	HS
12	AB-12	92.23(75.45)	HS	38	AB-38	100.00 (89.96)	HS
13	AB-13	05.00 (12.88)	R	39	AB-39	100.00 (89.96)	HS
14	AB-14	100.00 (89.96)	HS	40	AB-40	100.00 (89.96)	HS
15	AB-15	100.00 (89.96)	HS	41	AB-41	100.00 (89.96)	HS
16	AB-16	100.00 (89.96)	HS	42	AB-42	100.00 (89.96)	HS
17	AB-17	100.00 (89.96)	HS	43	AB-43	100.00 (89.96)	HS
18	AB-18	100.00 (89.96)	HS	44	AB-44	10.00 (18.42)	R
19	AB-19	100.00 (89.96)	HS	45	AB-45	75.00 (60.00)	HS
20	AB-20	11.00 (19.32)	MS	46	AB-46	65.45 (26.85)	HS
21	AB-21	100.00 (89.96)	HS	47	AB-47	100.00 (89.96)	HS
22	AB-22	100.00 (89.96)	HS	48	AB-48	100.00 (89.96)	HS
23	AB-23	100.00 (89.96)	HS	49	AB-49	00.00 (0.00)	HS
24	AB-24	00.00 (0.00)	HR	50	AB-50	00.00 (0.00)	HR
25	AB-25	10.00 (18.42)	R	51	AB-51	96.66 (79.94)	HS
26	AB-26	9.00 (17.32)	R	52	AB-52	03.33 (10.48)	R

# Human Capital and Economic Convergence in Indonesia : An Empirical Analysis

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**Abstract-** This study examines conditional convergence using the Regional GDP variable per capita of initial government expenditure, domestic investment, inflation and the number of high school graduates as an important human capital in p and the dependent variable is the average per capita Regional GDP in twenty six provinces in Indonesia to determine whether There has been conditional convergence ( $\beta$ ). The results showed that all provinces in Indonesia are still experiencing divergences. Initial per capita Regional GDP has a significant and positive effect on conditional convergence ( $\beta$ ), the increase in government spending will increase conditional convergence ( $\beta$ ). domestic investment positive but not significant, significant and negative inflation towards conditional convergence ( $\beta$ ), the number of high school graduates is negative and significant to conditional convergence ( $\beta$ ). The decline in the number of high school graduates increases the value of conditional convergence ( $\beta$ ).

**Index Terms-** Conditional Convergence ( $\beta$ ), human capital, Human Resources

## I. INTRODUCTION

Human capital has a very important role in supporting the development of the Indonesian economy because human resources become the subject of development that has a central role in managing resources owned in Indonesia. Economy. Todaro (2006: 11-12) defines economic development as a multidimensional process that includes structural change, attitude and institutional life. In addition, economic development includes increasing economic growth, reducing inequality income distribution and poverty eradication, to produce a series of economic advancements that are truly beneficial and through an efficient process.

Economic growth is influenced by the accumulation of physical capital and the accumulation of human capital. Both types of capital is an important factor that determines economic growth. Stern (1991: 128) states that the accumulation of physical capital and human capital is a determinant of growth. Economic growth followed by equal distribution of income became one of the goals of achieving economic convergence.

According to Islam (2003), how the income level of poor countries will converge to rich countries by themselves so as to have implications for human well-being. According to Barro and Martin (2004: 17), one of the predictions of the Solow (1956) and Swan (1956) models, which have been taken seriously as empirical hypotheses in just the last few years is the occurrence of conditional convergence. The lower the rate of initial per capita GDP relative to the long-term or steady-state position, the faster the growth rate. The determinants that influence the economic convergence can be domestic investment consisting of PMDN and PMA, and government expenditure on the province in Indonesia. Then added with variable number of high school graduates to know the role and influence of human capital on economic convergence. Thus put forward the problem is how the influence of macroeconomic variables factors (government spending, domestic investment, inflation and human capital) in influencing economic convergence.

## II. RESEARCHS ELABORATIONS

The basic theory of economic growth and the convergence of income is linked to the linkage between openness and economic growth. The hypothesis that openness can lead to better economic performance and contribute to the process of convergence of income between poor countries and the rich economy is supported by new growth theories.

Two concepts of convergence are discussed in Barro and Sala-i-Martin (1990 and 1992), Salai-Martin (1994), Bernard and Durlauf (1996) and Raiser (1998), and others. The first is the convergence of  $\beta$  which describes the inverse relationship between the level of initial income and growth. If an initially poor economy grows faster than the former is richer, there is a convergence of  $\beta$ . The other is the convergence of  $\delta$  that focuses on the inequality of actual income between regions or countries. If income inequality decreases, the region or economy in question reaches the convergence of  $\delta$ . It should be noted that the convergence of  $\beta$  is a necessary but inadequate condition for  $\delta$  convergence, or  $\delta$  convergence including  $\beta$  convergence, but not vice versa.

### III. FINDINGS

#### 1. Conditional Convergence with Variable Human Resources in Indonesia

To analyze the convergence of human resources, the number of residents who completed high school education for the 26 provinces included in the six corridors are Sumatra Island corridor, Java Island, Bali Island and Nusa Tenggara, Kalimantan Island, Sulawesi Island and Maluku Island and Papua. Based on the results of the research shown in Table 1.

Calculation of conditional convergence is done by using explanatory log variables per capita GDP (YCit-1) and then added with variables as determinant of growth rate of GRDP per capita consisting of government expenditure (Gi), domestic investment (PMDN), Inflation and Number of population SMA. Penghitungan conditional convergence is using panel data regression analysis with Fixed Effect Model approach. The use of the model is selected through the F test and Hausman test.

Based on Table 1, It can be seen that the value of R-squared is equal to 0.9955 or 99.55% which means 99.55% variation of initial GRDP variable, government expenditure, PMDN, inflation and Number of high school population in the model can be explained by PDRB variable (0.45% ) Is influenced by variables outside the model. If seen from the probability value of F statistic 0.000 <0,05 means that initial GRDP variable, government expenditure, PMDN, inflation and high school population together have significant effect to PDRB.

$$\text{Convergence-}\beta = 0.290627 + 0.890798 (\text{Initial GDP}) + 0.25050 (\text{Government Expenditure}) + 0,000883 (\text{PMDN}) - 0.020273 (\text{Inflation}) - 0,040981 (\text{Population SMA})$$

Based on the above equation it can be explained that with the initial estimation coefficient (parameter) of real per capita GDP is positive and significant with coefficient value of 0.890798 means that any one percent increase of PDRB per capita will cause divergence instead of  $\beta$ -convergence to be 0, 890798 percent, while the coefficient of government expenditure also statistically have a positive and significant effect. In the variable of routine expenditure, the coefficient value is 0,025050, meaning that every increase of one percent of routine government expenditure will increase the value of the  $\beta$ -convergence. This can happen because the Indonesian government is active in the development process in various economic sectors is also very instrumental in realizing the  $\beta$ -convergence. The PMDN variable shows a positive but not significant relationship. Based on the coefficient value 0.000883 means any increase of one percent of PMDN will not cause the convergence- $\beta$ . The inflation variable shows a negative and significant direction. Based on the coefficient value of 0.020273 means that any increase of one percent inflation will decrease the value of  $\beta$ -convergence. The variable of Indonesian population with high school education shows significant relation with coefficient value of -0,040981 meaning that every increase of one percent of Indonesian population with high school education leads to  $\beta$  convergence.

Table 1. Estimation of Conditional Convergence Regression With Fixed Effect Approach

Variable	Koefisien	Std. Error	t-Statistik	Probabilitas
Constanta	0.290627	0.076031	3.822484	0.0001
Log early per capita Regional GDP	0.890798	0.018321	48.62157	0.0000
Log GovernmentExpenditure	0.025050	0.003680	6.806648	0.0000
Log Domestic Investment	0.000883	0.000835	1.056644	0.2912
Log Inflation	-0.020273	0.002194	-9.238091	0.0000
Log High School	-0.040981	0.014588	-2.809152	0.0052
<i>Fixed Effects (Cross)</i>				
Aceh	-0.043219			
North Sumatera	0.006600			
West Sumatera	0.005686			
Riau	0.086772			
Jambi	0.017142			
South Sumatera	0.006630			
Bengkulu	-0.021169			
Lampung	-0.014658			
Dki Jakarta	0.125034			
West Java	-0.023974			
Central Java	-0.032579			

Di Yogyakarta	-0.020779
East Java	0.003228
Bali	0,004527
West Nusa Tenggara	-0.042762
East Nusa Tenggara	-0.099360
West Kalimantan	-0.021452
Central Kalimantan	-0.030820
South Kalimantan	-0.011070
East Kalimantan	0.135776
North Sulawesi	0.010742
Central Sulawesi	-0.005940
South Sulawesi	0.002033
Southeast Sulawesi	-0.006768
Maluku	-0.072946
Papua	0.034165
R-squared	0.995519
Adjusted R-squared	0.995241
Durbin-Watson stat	1.934459
F-statistic	3583.943
Prob(F-statistic)	0,000000

Source: Central Bureau of Statistics 1995-2015 (Processed 2017)

## 2. Conditional Convergence with Variable Human Resources in Western Indonesia Region

Based on the results of the research shown in Table 2, obtained R square of 0.995784 which shows that 99.58% of the average GRDP per capita can be explained by the model used.

Based on the F test results, the independent variable significance is shown by the probability value  $F = 0,000 < 0.01$  (ie the value of  $\alpha = 1\%$ ) it can be said that together the initial GDP per capita, government expenditure, PMDN, inflation and population High school graduates have an effect on average GRDP per capita, in other words changes to 5 (five) variables together will affect the convergence in the West Indonesia region.

While based on t significance t significance is smaller than 0.05, even smaller than 0.01 for Early GRDP variable (0,0000), government expenditure (0,0000), and inflation (0,0000), whereas for variable number of population graduates SMA, significance level  $t > 0.10$  ( $\alpha = 10\%$ ) it can be said that partially affect the occurrence of economic convergence or divergence. These findings support previous research conducted by Konya and Guisan (2008: 9) in African convergence measured by living standards with the Human Development Index (HDI) consisting of productivity.

Furthermore, based on the coefficient of negative signified in 9 (nine) provinces of Aceh, Bengkulu, Lampung, West Java, Central Java, DI Yogyakarta, East Java, West Nusa Tenggara and East Nusa Tenggara. The other 7 provinces have positive coefficient signs, namely North Sumatra, West Sumatra, Riau, Jambi, South Sumatra, DI Jakarta, and Bali. These results are also consistent with expected expectations, and in accordance with previous studies from Coulombe and Lee, 1955, found convergence in almost all Canadian provinces from 1961-1991, and Cashin 1995, indicating that there is convergence in seven Australian states. In accordance with previous opinions from Friedman (1992) and Hotelling (1933) which states that convergence in certain groups of countries has shown a decrease in income gaps within the group over time.

Table 2. Estimation of Conditional Convergence Regression with Human Resource Variable in West Indonesia Region

Variable	Koeffisien	t-Statistic	Prob.
Constanta	0.206116	2.406016	0.0167
Log early per capita RGDP	0.847990	35.33994	0.0000
Log GovernmentExpenditure	0.033246	7.326965	0.0000
Log Domestic Investment	0.001568	1.304901	0.1929
Log Inflation	-0.018815	-6.996759	0.0000
Log High School	-0.026853	-1.736745	0.0835

Fixed Effects (Cross)			
ACEH--C	-0.026581		
_NORTHSUMATERA--C	0.000835		
_WESTSUMATERA--C	0.005576		
_RIAU--C	0.134280		
_JAMBI--C	0.038353		
_SOUTHSUMATERA--C	0.012281		
_BENGKULU--C	-0.027796		
_LAMPUNG--C	-0.017141		
_DKIJAKARTA--C	0.167429		
_WESTJAVA--C	-0.048523		
_CENTRALJAVA--C	-0.057831		
_DIYOGYAKARTA--C	-0.017824		
_EASTJAVA--C	-0.011328		
_BALI--C	0.015372		
_WESTNUSATENGGARA--C	-0.050176		
_EASTNUSATENGGARAR--C	-0.124450		
<hr/>			
R-squared	0.995784	Mean dependent var	6.374854
Adjusted R-squared	0.995499	S.D. dependent var	3.065602
S.E. of regression	0.083823	Sum squared resid	2.079775
F-statistic	3495.707	Durbin-Watson stat	1.866704
Prob (F-statistic)	0.000000		

Source: Processed data, 2017

### 3. Conditional Convergence with Variable Human Resources in Eastern Indonesia Region

In order to analyze conditional convergence by adding variable human resources that is the number of population of high school graduates in eastern Indonesia region. Based on the results of the research shown in Table 3, obtained R square of 0.996032 indicating that 99.60% of the average GRDP per capita can be explained by the model used.

Based on the F test results, the independent variable significance is shown by the probability value  $F = 0,000 < 0.01$  (ie the value of  $\alpha = 1\%$ ) it can be said that together the initial GDP, government expenditure, PMDN, Inflation, and the number of high school graduates Affect the average GRDP per capita, in other words changes to the 5 (five) variables together will affect the convergence in eastern Indonesia.

Table 3. Estimation of Conditional Convergence Regression with Variable Human Resources in Eastern Indonesia Region

Variable	Coeffisien	t-Statistik	Prob.
C	0.665715	3.022049	0.0029
LN <sub>X1</sub> ?	0.947829	33.89469	0.0000
LN <sub>X2</sub> ?	0.019165	2.422053	0.0164
LN <sub>X3</sub> ?	-0.000483	-0.408714	0.6832
LN <sub>X4</sub> ?	-0.021307	-5.501767	0.0000
LN <sub>X5</sub> ?	-0.120459	-2.565526	0.0111
Fixed Effects (Cross)			
_WESTKALIMANTA--C	-0.006131		
_CENTRALKALIMANTAN--C	-0.035581		
_KALIMANTANSELA--C	-0.009097		
_EASTKALIMANTAN	0.049934		

--C	
_NORTHSULAWESI--	
C	0.023772
_CENTRALSULAWES	
I--C	-0.004412
_SOUTHSULAWESI--	
C	0.053282
_SOUTHEASTSULAW	
ESI--C	-0.009415
_MALUKU--C	-0.052266
_PAPUA--C	-0.012172

R-squared	0.996032	Mean dependent var	5.987245
Adjusted R-squared	0.995728	S.D. dependent var	3.213619
S.E. of regression	0.080627	Sum squared resid	1.189622
F-statistic	3280.868	Durbin-Watson stat	2.114937
Prob(F-statistic)	0.000000		

Source: Processed data, 2017

While based on t significance t significance smaller than 0.05, even smaller than 0.01 for Early GRDP variable (0,0000), and inflation (0,0000), while for government expenditure variable and the number of high school graduates, the level of significance  $t > 0.10$  ( $\alpha = 10\%$ ) then it can be said that the partial effect on the occurrence of economic convergence or divergence. These findings support previous research conducted by Bautista (2000: 85) on convergence in human capital between 31 states and the Federal District in Mexico, using the education index.

Based on the coefficient value that is marked negative there are 7 (seven) provinces of West Kalimantan, Central Kalimantan, South Kalimantan, Central Sulawesi, Southeast Sulawesi, Maluku and Papua. The other three provinces have positive coefficient marks, namely East Kalimantan, North Sulawesi, and South Sulawesi.

#### IV. CONCLUSION

Based on the research results it can be concluded that conditional convergence ( $\beta$ ) has not occurred in 26 provinces in Indonesia. This is because the process of development in the provinces in Indonesia is still ongoing, still requires a large government spending to provide good infrastructure and infrastructure, PMDN, stable inflation and high quality human resources.

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# Tight relations between E marketing and Touristic offer today

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**Abstract:** Tourism today is one of the most dynamic and most complex socio-economic modern age phenomena. In a short time it has grown into an industry that makes an important share in trade balance of many countries, creates numerous jobs and provides innumerable opportunities for economic growth and development of each country. Business trends in the modern tourist market are characterized by two trends, namely globalization and intensive development of information and communication technologies. Information has become available worldwide, competition is global and unmerciful, competitive advantage is short-term, and guests are sophisticated, demanding and less loyal.

For this reason, tourism bidders are forced to adapt to these changes and develop their marketing strategies accordingly. Accordingly, there is a question arising: how to position consumers in the modern tourist market and convince them that certain offer is precisely what they are looking for. How to highlight and emphasize advantages of particular offer?

**Keywords:** Promotion, follow trends, E marketing services in tourism, promotion over Internet.

## Introduction

The answer lies in the effective and creative promotion policy. Promotion is one of the main elements of a marketing mix, and its task is to inform potential and existing users about service existence, to influence the creation of positive preferences, and to stimulate the desired response. The successful business of each subject in tourism must be based on constant communication with consumers and adapting to changes in the environment. For this reason, promotional activities, as a specific form of communication with consumers, are of crucial importance in modern business.

The aim of this paper is to point out the importance of promoting tourism services and show the effective promotion management in theory and practice, all of that in order to emphasize its contribution to business advance and profit increase of each tourist provider.

**Marketing promoters in tourism** are all those who take part in the tourism market with their products and services and meet tourism needs through tourist spending. The heterogeneity of the tourist offer explains the large number and variety of marketing providers in tourism. They differ according to the type of tourism business they carry out, in terms of business volume, market position and type of tourist product they offer.

It can be concluded that the basic elements of a tourist product are accessibility, attractions, capacities, prices and image. Availability means that a potential tourist must have sufficient information about the product and that the product must be accessible to traffic.

**Tourist attractions** make the tourist product interesting and attractive. Tourist attractions are considered to be particularly appealing features, ie those resources that are to some extent adapted and accessible to tourist sightseeing and do not require special effort to be discovered and enjoyed.

- Capacity as part of a tourist product implies facilities providing services Accommodation, catering facilities and other facilities such as sports grounds, agencies, tourist bureaus and the like.
- Price is an important aspect of the tourist product, and for tourists it implies the sum of all the costs incurred by visiting a destination. It varies depending on the quality of the tourist product and depending on the season.
- When it comes to the image of a tourist product, it is the result of objective information and through the time of perception created. The tourist after the visit to the destination brings his attitude to satisfaction or dissatisfaction with what he expected from the visit, based on the previously created mental image or image.

In marketing, distribution systems traditionally use to move goods from producers to consumers, and in tourism, distribution systems are used to bring a client's product to a hotel, restaurant, airplane or some other tourist provider. Well-organized sales channels will be a successful business with a high market share than the one struggling to survive. Marketing communication is a dual process of information exchange between Participating in marketing.

Conversely, promotion is considered a single one During information or persuasion that affects an individual, company or someone Another organization to get started in the desired direction. Under the terms of promotion in Tourism should be considered as all activities of information, persuasion and reminders to which Tourist supply providers stimulate sales on the tourist market.

### **Internet marketing**

Internet marketing is defined as "meeting market goals through the use of the Internet and technology-based ones". Every company in their marketing activities relies on the use of the Internet. The first step in Internet marketing is domain name registration, which is why the Internet site address has the role of "phone

number" for people trying to access it. Tourism companies then develop web sites that contain web sites, which are World Wide Web files containing text, images and sound. Websites thus represent the company in a similar way as the brochures are tractive.

Collecting information in tourism is a complex process and involves gathering information from a variety of sources, such as travel agencies, internet portals, videos, travelogues, catalogs and travel brochures, tour operators, newsletters, info points, social networks, carriers etc. Communication messages, How those broadcast by television programs, the Internet or other channels function as a recommendation to tourists, and in this sense their sociological role must not be neglected.

People want to appear on social networks and share their knowledge and experience and information with other users for various reasons. People usually become motivated to share important information with their online friends as they expect their experience to help or at least benefit.

### **Internet marketing in tourism**

The place of promotion of hotel services takes the promotion of the institution, with particular regard to orientation towards experience and service offerings, and as the main media in promotional activities, highlights digital and electronic media that offer consumers multimedia content (videos, videos, etc.) about Hotel offerings and accommodation facilities, as well as additional facilities that are intended to attract potential hotel service providers. Regarding role and importance of marketing concept in modern hotel business, emphasis should be on marketing mix settings, optimum combination and strategic planning geared towards the market business concept.

Today, as a form of direct marketing, Internet marketing is increasingly used. Internet marketing represents a significant transformation in the conduct of promotional marketing activities, especially the use of electronic mail and Internet presentations. Internet marketing has significantly eliminated mediation.

**The basic benefits** that users have from the Internet are:

- Constant availability through affordable conditions,
- Global character,
- Providing a special value through price and product comparison,
- facilitates purchasing decision making based on the assessment of alternative products and service organization offers

Internet has significantly improved, accelerated and created new ways to promote tourism.

**Promotion** of the country through the Internet is done in various ways, from official state sites, through specialized tourist portals, hotel port websites, and to international web portals related to the promotion of tourism and hotels. On the other hand, Internet has basically provided tourists with a number of advantages,

most of which are reflected in the fact that a large amount of high-quality information can be found in one place.

Making a **web presentation** and providing the information you need is just one of the tasks. Much more important is the strategy of attracting guests and answering questions, bringing them, making them out of customers and keeping them.

The **task of marketing** is to manage the relationship with potential and previous guests, motivate them with attractive offers, promotions and prizes, and otherwise act consciously in order to achieve business benefits.

**Through social networks** and other specialized applications available on the Internet, guests can view accommodation reviews and give their opinion on the quality of the service being provided. Recommendations and advice given by previous guests to potential guests represent the most influential factor in the evaluation and choice of the hotel, as they give a look from the guest perspective and provide an indirect experience.

### **Online Offer via booking platforms- the way of today tourists**

There are numerous online portals, as representatives of hosting consumers, that connects "hosts" who want to entertain a part of their home for a fee for "guests" who need accommodation. This platform represents a direct link between the offer (hosts) and demand (guests). Some are rented their room to people who could not find accommodation in hotels following a major conference held. There are over several millions site profiles available today, out of which over few thousands traps, to tens of thousands cities in over 190 countries. The number of overnight stays reached hundreds of millions.

Collaborative Consumption has been created thanks to the Internet and the ability to directly disseminate information to the entire population. Collaborative Consumption is one of the fastest growing markets. Ordinary people become micro entrepreneurs who rent or exchange their resources to earn revenue.

The popularity of this platform, in addition to aggressive expansion and quality bidding, has come from a simple, comprehensive and exhaustive search facility. In order to use the services of this portal, registration is required, which is completely free and is allowed to everyone.

On the home page is, always, a search engine where you need to enter the search parameters in terms of the desired destination, the date of arrival and departure and the number of guests. Results are shown in the left hand side of the list, and the folders on the right.

At the top of the site, the guest can choose a type of accommodation in the form of a full-time, private room or delimited room. It is usually also possible to filter the results by using the parameter in terms of price, number of bedrooms, number of bathrooms, additional content or the language spoken by the host.

In the header beside the host image one can find information about accommodation itself, such as the type of accommodation, capacity, number of bedrooms and the number of beds. In addition to this information there is also a rating of star ratings given by the previous guests on the basis of 5 criteria such as:

- overall experience,
- cleanliness of accommodation,
- host communication,
- accuracy of information,
- location and
- value for money.

The description of the accommodation is written by the host and in this section, beside the description of space and the general information in terms of reception and departure times, guests can also find information about additional amenities that enable potential guests, to find the type of accommodation that meets all of their requirements during the search. In addition to additional content, minimum nightly, cancellation policy, security deposit and security devices are also available.

Comments on site can be left on guest or host profiles only if there is a previous link between them in terms of booking and guest accommodation in the given rented object of the host. Comments have a significant influence on the perception of future guests about the space and the host, starting with the experiences of the previous guests.

Guests and hosts can leave comments on their experiences in the period of their stay, but usually in order to reduce the impact of the comment left by host or host guests, and vice versa, these comments will be released only when the guest and the host are left their comments, or after the deadline for comment, emphasized upfront.

There are 3 ways to book your stay: instant booking, prior approval and reservation request.

**Instant booking** does not imply prior communication with the host and guest can immediately reserve the accommodation if the dates listed in the search are free. Hosts can choose this type of booking to avoid communicating with guests and shortening the time of booking confirmation. If this kind of reservation is available, a light sign will appear at the end of the search.

**Upon approval**, the hosts provide guests who have come in contact. This reservation method is a reservation invitation that the host can send during the conversation. Before the approval is valid for 24 hours from the time of issue and the hosts can send more before the approval at the same time, the reservation confirmation will go to the guest who first confirms the reservation,

**Reservation request** is one of the most common types of reservation. In order to make a reservation request, the guest must enter details from his payment card or PayPal as the host has 24 hours to confirm the reservation. The guest will be charged a full sum when the host confirms the booking.

### **The payments**

In order to ensure the safety of guests, online booking portal upon reservation and billing of guests, the funds is not delivered to the hosts immediately but after the expiration of 24 hours upon receiving guest payment, so that guests in case of any problems with the host or the accommodation can inform site and look for alternative accommodation.

The fee paid to online booking portal from guests is, usually, 10% of each transaction. Hosts are charged with, usually, 3% of the cost of the stay. Payment is made via internet and it is possible to pay by card or through some different internet payment service. Also, payment is, mostly, available in multiple currencies.

Development of the internet has increased opportunities for growth of hotel industry. Hotel managers are fully aware of benefits that internet offers in terms of advertising and therefore they are motivated to create more attention of their hotels in order to get more online reservations. They need to know how to achieve mutual interaction with guests. Hotel website or online presence allows hotel managers to easily stay and stay in touch with potential customers. Efficiently managed web sites can be the best media to create customer relationships, creating a hotel brand, retaining guests, and encouraging the oncoming visit of a hotel guest.

Without the use of information technology, hotel business would not be possible. Hotel chains depend on technology because the service process can not be imagined without operating the operating system for booking, e-mails, and the use of communication devices. Today, hotels need to have strong support for the system, so they can organize great events with video conferencing, the flow of the internet is fast and stable, where the image of the event can go directly to other parts of the world. All this provides information technology.

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# An Evaluation of Conservation Strategies on Plant Biodiversity in a Peri-Urban Set-Up of Kajulu-Riat Hill, Kisumu City, Kenya

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**Abstract-** Urbanization is a complex and dynamic process playing out over multiple scales of space and time. In addition to being increasingly physically expansive, urban land change is also predominantly characterized by peri-urbanization, the process whereby rural areas both close to and distant from city center become enveloped by, or transformed into, extended metropolitan regions. This present study focused on the peri-urban establishment of Kajulu-Riat hill area within Kisumu City in Kenya. It focused on the conservation strategies on tree and shrub diversity and how it is affected by other urban socio-economic dynamics. The study population comprised a sample of 384 persons within the geographical areas of kajulu and Riat peri-urban. Among the community members interviewed include; villagers, traditional leaders, community members who were 60 years and above of age, local craft-work traders, medicinal plant collectors, fuel wood gatherers, charcoal burners and vendors. Majority of those who participated in the study were male respondents who accounted for 58% (n=223) while the female consisted of 42%, (n=161). Small scale farming was an important livelihood in the study area (32.3%), followed by self-employment (29.9%) who included traders, miners, riders and mechanics. The customary land tenure system dominates in the study area (44%) followed by private land tenure system (26%), the trust land (22%) while the public land recorded 8% of the respondents. Major conservation initiatives include: promotion of climate and ecosystem smart livelihood, domestication of trees, afforestation and agro-forestry. However majority of the respondents did not take part in the conservation strategies indicating a clear lack of interest in environmental conservation. Urban priorities such as roads, housing, water and sanitation were of higher priority compared to environmental conservation. The results indicates the need to integrate livelihoods and poverty in planning for a sustainable peri-urban environmental conservation which is key in building resilience to climate change and related disasters.

**Index Terms-** Conservation strategies, plant biodiversity, socio-economic priorities

## I. INTRODUCTION

Urbanization is a complex and dynamic process playing out over multiple scales of space and time (Grimm et al., 2008). Historically, cities have been compact and have concentrated

populations. Today, cities are increasingly expansive. Across the world, urban areas are growing on average twice as fast as urban population (Seto et al., 2011). In addition to being increasingly physically expansive, urban land change is also predominantly characterized by peri-urbanization, the process whereby rural areas both close to and distant from city center become enveloped by, or transformed into, extended metropolitan regions (Simo et al., 2004; Aguilar et al., 2003). These results in a tight mosaic of traditional and agricultural juxtaposed with modern and industrial land-uses and governance systems. As a physical phenomenon, peri-urbanization involves the conversion of agricultural land, pastures, and forests to urban areas. Moreover, changes in lifestyles and consumption patterns associated with urbanization, especially increasing demand for residential energy and water, is placing dramatic pressures on ecological services (Hubacek et al., 2009).

This present study focused on the peri-urban establishment of Kajulu-Riat hill area within Kisumu City in Kenya. It focused on the conservation strategies on tree and shrub diversity and how it is affected by other urban socio-economic dynamics. In Kisumu city, increased urbanization has placed tremendous pressure on urban environment particularly on the trees and plants which have either been cut down and used or removed as land is converted to urban buildings (NEMA, 2009). With an annual growth rate estimated at 2.8% and densities of 828 persons/ km<sup>2</sup>, Kisumu City has one of the highest urban population densities in the country, bringing with it the associated complexities in urban planning (UN-Habitat, 2012). The city faces systematic challenges and threats among the urban community ranging from poor urban physical planning and infrastructure services, degraded urban environment, loss of biodiversity and therefore increased urban poverty. According to (Baker, 2006), in many instances biodiversity concerns are seen as less important than other urban pressures such as poverty, unemployment, underemployment, access to food, energy, crime, pollution, congestion, housing shortages, spontaneous settlements and food supply issues. Biodiversity is one of the primary foundations for human physical and psychological health and wellbeing. Numerous studies have demonstrated that investing in ecosystems makes economic sense because safeguarding urban ecosystems strengthens the ability of cities to adapt to climate change and transition to a more healthy and sustainable future (Bowler et al., 2010; Sala et al., 2000).

Similar study in Japan showed an intensive growth of industries during the rapid economic growth period from the late

1950s to the early 1970s in Japan created employment opportunities, led to population concentration, and ultimately urbanization. The rapidly expanding cities resulted in conversion of farmland to urban land, first along the coastline, then into forests and in-land (Himiyama 2004). In the process, people's traditional ways of making their livelihoods significantly changed (Okuro et al., 2012). In the rural areas, modernization and mechanization of agriculture created monocultures, which decreased biodiversity (Okuro et al., 2012). At the same time, forestry and fisheries collapsed due to the expanding cities and the import of timber and seafood.

## II. MATERIALS AND METHODS

### 1.2.1 Description of the Study Area

The study area lies within Kisumu County in the western part of Kenya and it is located approximately 10 kilometres from the Kisumu Central business district appendix 2. Kisumu City is situated on (0° 5'30.1272''South) and (34° 46'4.6416''East). It lies besides Lake Victoria with an altitude of 1188 m above sea level and the Nyando escarpment to the north. Figure 3.1 shows map of the study area.

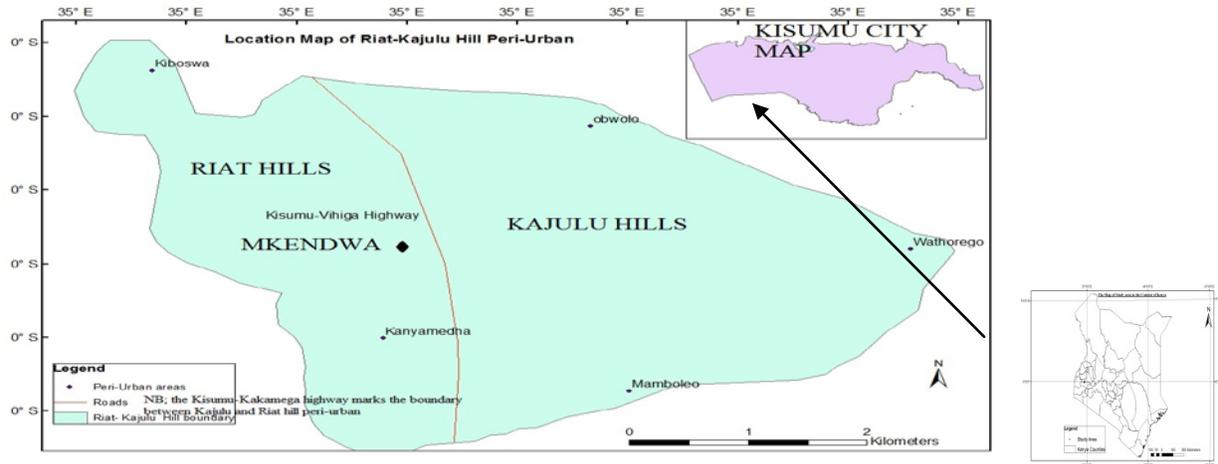


Figure 2.1: Study area map (Source: Author, 2016)

### 1.2.2 Climate and water resources

Kisumu city has sub-humid and semi-humid tropical climate with mean maximum temperatures ranges from 27.7°C to 30.8°C and rainfall that varies with altitude. The mean annual rainfall varies from 1100 mm in the south to 1500 mm in the north and potential evaporation of 2200 mm and 1900 mm respectively. It is the largest city in western region of Kenya and second most important city after Kampala in the greater Lake Victoria basin; it is also the third city in Kenya. Dunga Beach and Wetland within the city is known for its unique eco-cultural attractions due to its biodiversity and cultural rich and diverse papyrus wetland ecosystem and local community respectively, Kisumu City borders Lake Victoria which is the second largest fresh water lake in the world.

### 1.2.3 Natural resources and biodiversity

Kisumu has an impala sanctuary just within the City. During the British rule, the Impala Park, now sanctuary was called Connaught Parade. Measuring just 0.4 square miles (1.0 km<sup>2</sup>), the sanctuary is one of Kenya's smallest wildlife preserves. As its name suggests, it is home to a herd of impala. Some hippos, as well as many reptiles and birds are also present. Urban and peri-urban farming practices in Kisumu largely include small-scale rain-fed mixed farming, small-scale river irrigation, wetland farming, fish farming and free range livestock keeping. The most intensive agriculture is practiced along the lake shore in the lower-lying flood plains of Nyalenda and Dunga, and in the wetlands to the South of the city. Larger plots under agriculture are found along the foothills to the east bordering the peri-urban fringe. Over the years, the Kajulu-Riat

hills have undergone gradual deforestation, resulting to a vegetation cover consisting of low level shrubs. Continuous soil erosion has left rock outcrops dotted all over the hill (LVEMPII, 2012). The hills have springs that are a source of streams that join to form small rivers draining into Lake Victoria, including River Nyamasaria and River Kisat. They are also major sources of water for the Kisumu city, with a water intake in place, wide variety of common and rare species of birds and Vervet monkeys also inhabit the hill. East of Kisumu Town is the Kano Plains occasionally broken by low ridges and rivers. There are some notable physical features such as the scarps in the north, east and south. Others include the hill slopes and piedmont plains spreading across the vast Kano Plains. The shores of Lake Victoria in Kisumu city have been used to put up beautiful tourist hotels like Kiboko Bay, the Yatch Club and Tilapia Beach Resort.

### 1.2.4 Major economic activities

Economic activities can be the indicator of the types of livelihoods in the city and can provide general information on the local workforce. Livelihood opportunities can also affect the growth rate of cities and allow people to settle in the city. Currently, Kisumu is the third largest urban centre in Kenya, acting as a commercial, industrial, communication and transportation hub for the lake basin region (KCC, 2004). Its economic significance comes primarily from its location on the shores of the Lake Victoria, which connects it to Uganda and Tanzania. Over the past decades (1960s and 1970s), Kisumu was a successful economy and large manufacturing hub with well developed sugar, cotton and fishing industries. The main sources

of income in the informal sector include; employment in manufacturing and processing plants, informal trades, fish trade, sale of briquettes and water vending services, urban livestock and agriculture at the subsistence level, public transportation ('Boda boda') among others. Inadequate and unreliable rainfall patterns affect agricultural activities which is the main source of livelihood of the population (KCC, 2004).

**1.2.5 Population growth trend**

Kisumu grew from new settlements since the beginning of the railway station for Uganda in 1901. According to (Kisumu

County Government, 2013), Kisumu had a population of around 500,000 persons as per 2009 population census data. Kisumu is one of the rapid growing cities in Kenya with an urban growth rate estimated at 2.8% and has around 824 persons per square kilometer population density. Kisumu city is undergoing rapid urbanization as more and more people immigrate to the area in search for employment, settlement area and education facilities among others. Table 3.1 shows the population trends of the sub-locations in the study area.

**Table 2.1: Population projection of the study area by (sub-location in Kajulu-Riat hill peri-urban). Source: MCI (2007). Projections are based on government of Kenya 1999 census figures derived using an exponential growth function and a 2.8% growth rate.**

Location	1999 census data	2010 projection	2011 projection	2015 projection	Area ( km <sup>2</sup> )
Kanyakwar	8576	11660	12001	13423	8.5
Kogony	13961	18982	19536	21851	13.1
Wathorego	7170	9747	10033	11222	9.8
Konya	10308	14015	14424	16134	11.9
Mkendwa	667	907	933	1044	0.8

**1.2.6 Sample size determination**

The target population in this case is more than 10,000 and the desired accuracy is sought at 0.05 significance levels, the z statistic is 1.96. With a target population of approximately 46,496, the study used the following formula as proposed by Mugenda and Mugenda, (2003).

$$n = \frac{z^2 pq}{d^2}$$

Thus the sample size was calculated as shown below:

$$n = \frac{z^2 pq}{d^2}$$

Where,  
 n = the desired sample size (if the target population is greater than 10,000)  
 z = the standard normal deviation at the required confidence level  
 p = the proportion in the target population estimated to have characteristics being measured  
 q = 1-p  
 d = the level of statistical significance set  
 Therefore,  
 $n = \frac{(1.96)^2 (.50)(.50)}{(0.05)^2}$

=384 respondents

**1.2.7 Study population & sampling design**

The study population comprised a sample of 384 persons within the geographical areas of kajulu and Riat peri-urban. Among the community members interviewed include; villagers, traditional leaders, community members who were 60 years and above of age, local craft-work traders, medicinal plant collectors, fuel wood gatherers, charcoal burners and vendors. Other Stakeholders were defined in accordance with Borrini-Feyerabend, (1996) as social actors who have a direct, significant and specific interest in an area's natural resources, are aware of their own interest in management of the resources, possess specific capacity (skills, knowledge) and comparative advantages (proximity, mandate) for such management, and are usually willing to invest specific resources (i.e. money, time, authority) toward some form of management. In this study 20 stakeholders from different sectors were interviewed. As shown on Table 3.3, they included staff from the departments of forestry, agricultural, environment and tourism, nature conservationists, forest-based researchers and non-governmental organizations [NGOs].

**Table 2.2: Summary of the sampled population**

Unit of population	Sampling Design	Number of units	Proportion from the total population in the unit
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Kisumu County Ministry of Environment office	Purposive and snow ball sampling	2 officers,	25% of the staff in the department
Osiendela Kisumu	Purposive and snow ball sampling	4 officers	40% of the staff
Ecofinder Kenya ( Kisumu)	Purposive sampling	4 officers	31% of the staff
Kenya Forest Service	Purposive sampling	4officers	29% of the staff
Kenya Wildlife Service	Purposive sampling	2 officers	22% of the staff
KEFRI	Purposive sampling	4 senior officers	31% of the staff
Community members around Kajulu over 60 yrs	Snow ball sampling	24 people	
Other community members in and around kajulu hills	Simple random sampling	360 people	
Total		404	

**1.2.8 Questionnaire and Survey design**

Interviews are important especially where individual accounts or information are required on how a particular phenomenon develops (Robson, 2002). It also helps in understanding perceptions of processes within a social unit, and helps in seeking answers to the research questions concerning a given subject. It also allows the investigator to have a face to face contact with respondents hence enabling researchers to catch a glimpse of the non-verbal expressions and feelings of the respondents on the issue of environmental conservation. Interviews were conducted with key community resource persons and various environmental stakeholders in Kisumu City to get informed on various conservation initiatives and strategies used by different organizations. Through the snowball technique; where by one organization referred the researcher to another relevant organization, more organizations were reached for the study. Some organizations such as OSIENALA: (a local non-governmental organization), LVEMPII, Ministry of Environment for Kisumu County, Kenya Forest Service and Kenya Wildlife Service were reached with a total of 20 stakeholders from different organizations being interviewed. Site visits were conducted in the study area with the help of a key informant to confirm the existence of conservation strategies.

Semi-structured questionnaires, having both open-ended and closed-ended questions were administered to the local community within the study area. Open-ended questions provided the required space for statement and clarification allowing for in-depth probing. Questionnaires enable a researcher to make use of large samples and thus the results can be more dependable and reliable (Kothari, 2003). The questionnaires were administered with the help of research assistants who first underwent training on approach and instrument administration. The questionnaires captured socio-demographic characteristic of the respondents and other conservation related issues.

Three focus group discussions were held with opinion leaders to encourage debate on issues relevant to the study. The FGD at Wathorego location consisted of 16 members, Kanyakwar location 13 members and at Kogony location 12 members. This was to help in expanding the meaning of answers obtained from standardized interviews and in capturing themes

that were conveyed by the participant’s experiences, feelings and thoughts. Gender balance was emphasized in the selection process. Qualitative information obtained from the discussion was confirmed from survey and secondary data.

**1.2.9 Data analysis**

Both descriptive and inferential statistical techniques were employed. According to (Healey, 2011), descriptive statistics allows researchers to summarize large amounts of data using measures that are easily understood by an observer. The significance of the difference in the distribution of data was established using Chi-square test. Chi square was used to determine whether there was any statistically significant difference between variables of the study. According to Kothari (2004), this technique is the most widely used method of testing for statistical significance between variables. The Statistical Package for Social Science (SPSS version 20.0) computer software was used for the purpose of analyzing the data which was presented in figures, tables and narrative reports.

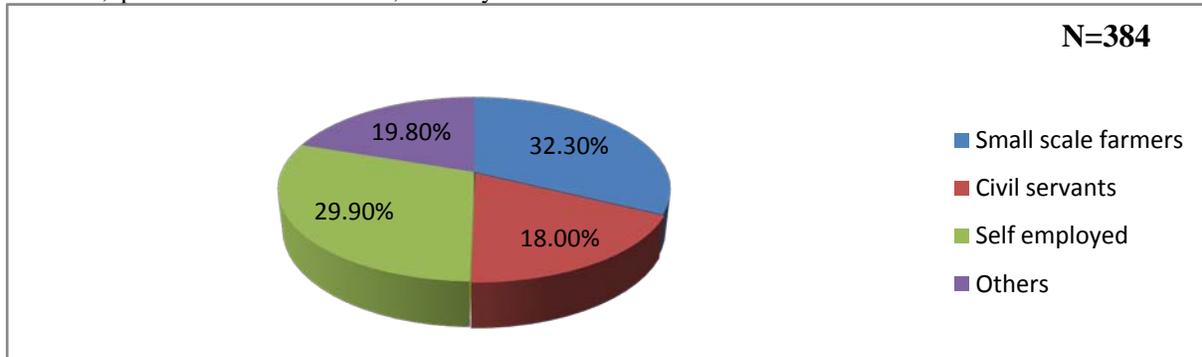
**III. RESULTS AND DISCUSSIONS**

**1.3.1 Socio - Demographic characteristics**

Majority of those who participated in the study were male respondents who accounted for 58% (n=223) while the female consisted of 42%, (n=161). The distribution of values showed statistically significant difference, the variables had  $\chi^2 = 10.010$ ,  $p=0.002$ . This means that there could be gender disparity in the study area. According to World Bank, (2009), to make environmental conservation and restoration effective, social factors including gender appreciation on land use must be considered. Women play an essential role in the management of natural resources, including soil, water, forestry and energy and often have a profound traditional and contemporary knowledge of natural resources around them.

The occupation of respondents in the study area consisted of small scale farming, self-employment, civil service, and others. Small scale farmers were the majority (32.3%), followed by self-employed (29.9%) who included traders, miners, riders

and mechanics. The civil servants who consisted of teachers, health practitioners, provincial administrators, forestry officers and security guards were the least.

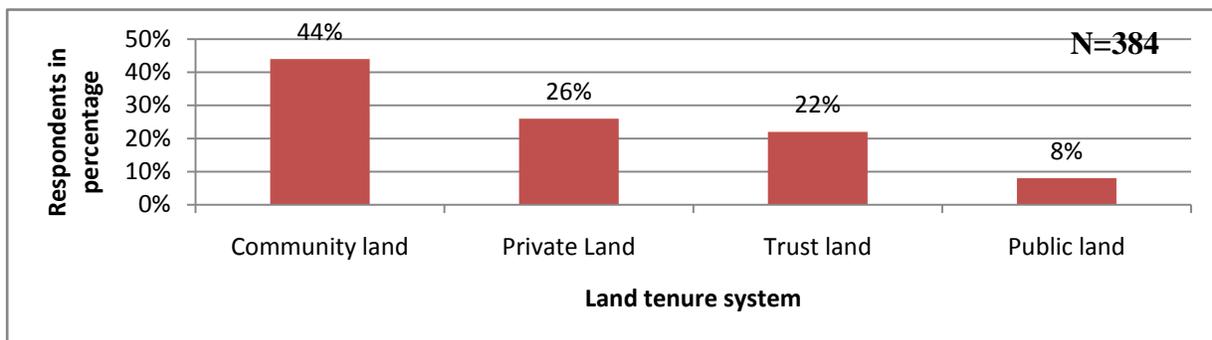


**Figure 3.1: Major livelihoods in the study area**

Chi-square test showed that there was a statistically significant difference among the occupations  $\chi^2 = 23.688$ ,  $p < 0.05$ , which means that small scale farmers are the majority and therefore farming is an important source of livelihood in the study area. According to the Government of Kenya, 2012; the official unemployment rate of Kisumu City is 30%, but 52% of the working population is engaged in informal sector activities (e.g. transport, petty sales, repairs). Occupations that are linked directly to land and natural resources such as agricultural practices and charcoal vending are likely to have a great impact on trees and other plant diversity. In Brazil, *Cerrado* which is one of the richest savanna ecosystems in the world was

transformed by intensive human occupation process into one of the most important regions for cattle ranching and commodity crops, this led to *Cerrado* being classified as one of the World's biodiversity hotspots where by between 2003 and 2007, 18,980 km<sup>2</sup> of new deforestation had been realized (Myers *et al.*, 2000, Ferreira *et al.*, 2007).

There were statistical significance difference in the land tenure system of the area,  $\chi^2 = 100.875$ ,  $p < 0.05$ . The customary land tenure system dominates in the study area (44%) followed by private land tenure system (26%), the trust land (22%) while the public land recorded 8% of the respondents.

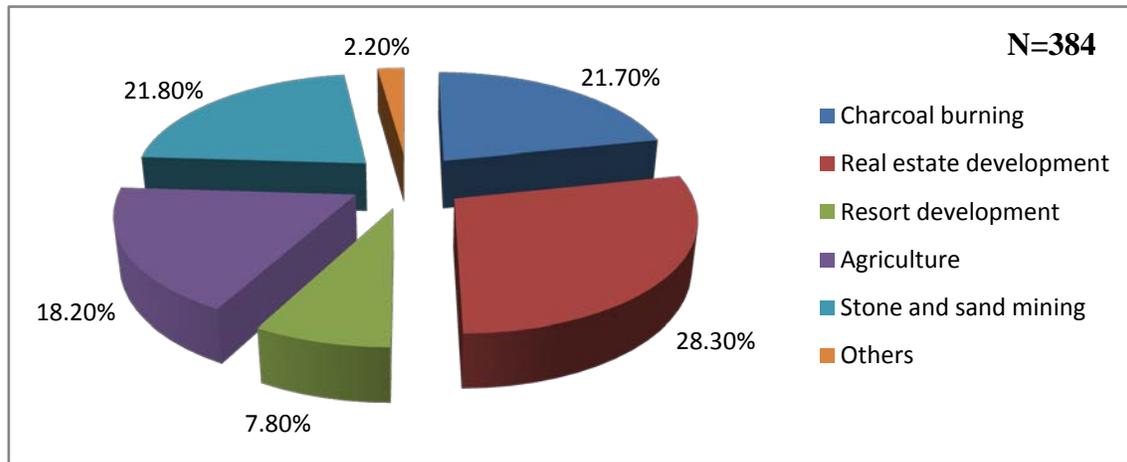


**Figure 3.2: Land tenure system in the study area**

The (26%) of private tenure may mean that many people are buying land in the area for settlement from other areas or the customary land is being subdivided among family and clan members to cater for the changing demands of land in the area. The expansion of urban land into agricultural hinterland due to demographic pressure could be forcing the customary land tenure practices which have existed for centuries in the area to adapt and adjust to the new situations. According to Wamukaya (2008), in the peri-urban areas of Kisumu city, successive local authorities have shown an apparent weakness in controlling or guiding urban land use development. Property owners can do as

they wish with their lands subject to family and communal obligation that may apply depending on the prevailing land tenure. Municipal officials have found it nearly impossible to achieve harmony, delight and efficiency in the planning process when ownership of large parcels of land adjacent to the city is held under customary tenure.

According to the respondents the major causes of land cover change were the real estate development at 28.3%, rock and sand mining at 21.8% and charcoal burning, 21.7% (Figure 3.3).



**Figure 3.3: Respondents view on the drivers of vegetation change in study area**

The cause of land cover change differed significantly  $\chi^2 = 108.781, p < 0.05$ . This suggests that the construction industry was the current and future threat to plant biodiversity in the area. The Kajulu – Riat hills peri-urban has attracted real estate development for the middle and high class citizens due to its aesthetic view of Kisumu city and the winam gulf of lake Victoria. The Riat Kajulu hills offer a panoramic view of Kisumu town, from certain areas one can see breathe taking views of the sunset, which is reflected on the waters of Lake Victoria. This could explain the reason why real estate is termed as the main cause of tree and plant diversity changes. Some of the residential estates in the area include “Uhura estate, Uzima estate, Kajulu estate, Kanyakwar and Kanyamedha estates off Kisumu

Kakamega Highway”. According to Simon (2008), peri-urban areas are increasingly attracting middle-class and higher income people whose lives exhibit lifestyles reflective of inner-city dwellers in a predominantly rural setting.

### 3.1.2 Conservation initiatives in the study area

Identification of the existing conservation strategies in the study area was done through enquiries from the key respondents; ground truthing, review of secondary literature and from the focus group discussions. Various organizations were identified with their conservation strategies in the areas (Table 3.1).

**Table 3.1: organizations and conservation strategies**

Name	Organization type	Conservation strategies
Eco-finder	NGO	Climate and Ecosystem smart livelihood, Green energy program, leadership and advocacy, IT and entrepreneurship in relation to environment
OSIENALA	NGO	Domestication of trees, Development of sustainable tree seed system, Farmer for the future approach
Kenya Forest Service	Government agency	Re-forestation, protection of trees
LVEMP II	parastatal	Agro-forestry , sustainable land management practices

From the study, the four organizations in Table 3.1 were identified to have spearheaded the various conservation strategies in the study area. Eco-finder is a non-governmental organization

based in Dunga beach in Kisumu City. Although their main goal is to spearhead wetland restoration and protection and help riparian communities adapt to climate change, they had

supported some farmers groups in the study area with clean cooking stoves and biogas system. This was to reduce overdependence on use of fuel wood and charcoal as a source of energy thus conservation of trees and plant biodiversity in the study area.

Osiendela is also a non-governmental organization, named in dholuo language meaning friends of Lake Victoria. It is a regional organization that covers the entire Lake Victoria basin in the three countries that shares the lake. In Kisumu, they own a radio station that broadcast in local language focusing on environmental conservation, protection and restoration through; promotion of sustainable fishing practices, addressing poverty and environmental degradation, pollution and the causes of lake sedimentation. In the study area they have promoted domestication of trees, community ownership of nurseries and school based program where pupils are taught to grow trees.

Lake Victoria environmental management program II is an initiative that addresses various environmental challenges around the Lake Victoria basin. In some parts of the study area, they have partnered with the Kenya forest service to spearhead re-forestation with the objective of improving community livelihoods through benefits from tree products and non wood

products, ecotourism, restoration and conservation of the hill biodiversity and conservation of soil and water in Kajulu area. However from the discussions with key informants the challenges towards sustainable afforestation in the study area included: absence of forest policy, free grazing, lack of institutional coordination, lack of indigenous tree seeds, land holding system and lack of indigenous knowledge on sustainable conservation.

### 3.1.3 Awareness on the conservation strategies

The study sought to establish the awareness of the respondents on the existing conservation strategies in the study area. The results are categorized into three with regards to those who were correctly aware, those who were not aware and those who were misinformed (Figure 4.12). From the study, the level of awareness on the existing conservation strategies in the study area was very low with those who were correctly aware being 7.03% of the sampled population; however there were those who purported to be informed of the existing strategies but were misinformed. Majority of the respondents were not aware of the existing conservation strategies in the study area at 82.29% of the respondents.

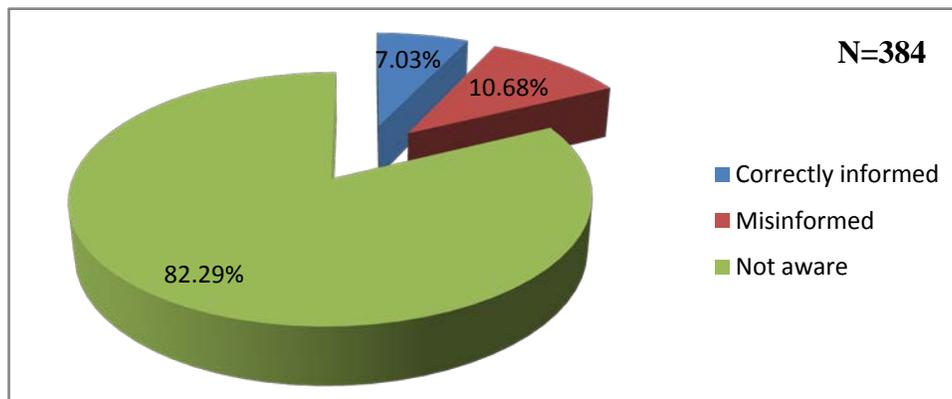


Figure 3.4: Respondents awareness on the existing conservation strategies in the study area.

The findings were statistically significant different  $\chi^2 = 414.953$ ,  $p < 0.05$ ; which means, the adoption of the conservation strategies initiated by the various stakeholders is still very low within Riat-Kajulu hills peri-urban. There is an increasing popular awareness that sustainable environmental restoration and rehabilitation is unachievable without public participation (Bass 2001). Lack of awareness among respondents could be attributed to the top-bottom approach being used by the various organizations in spearheading their various conservation drives in the study area where by the local community lacks a clear picture of the objectives of the conservation strategies, Sustainable environmental restoration and rehabilitation is unachievable without public participation (Bass 2001). Borgstrom, 2009, in their study on restricted plant species on sub-Antarctic Macquarie and Heard Island found out that; achieving the necessary political support and changing the habits of residents is made difficult by the lack of awareness about the diversity of nature, its complexity, as well as human dependence on ecosystem functions across scales.

Lack of awareness on the existing conservation strategies could also be attributed to the skewed allocation of the various

conservation resources, mostly in rural set-ups. This showed that there was urban forest inequality in the study area through unequal distribution of ecological resources Hope *et al.*, (2003). The study was mainly focused on the peri-urban areas and from the survey, it was established that the various initiatives were done in the rural set up with only few on the peri-urban side of the Kajulu area. The afforestation project for instance had been skewed in one area of Kajulu hill ecosystem where the population is dispersed. Temporal, spatial, and functional mismatches between ecosystems and the institutions managing them could be an overarching challenge in ecosystem governance in the study area (Cumming *et al.*, 2006).

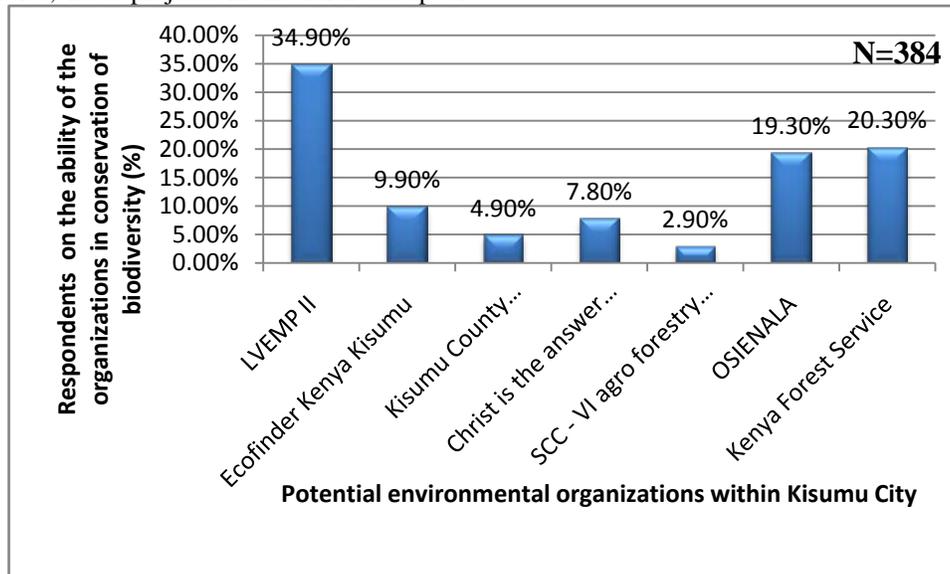
### 3.1.4 Respondents views on key stakeholders involved in environment

The study sought to establish how the respondents view key environmental stakeholder's ability to spearhead conservation in the area. Majority of the respondents believed LVEMPII, Osiendela and Kenya forest service had the potential of spearheading conservation initiatives in the study area in the near future. However some other stakeholders such as the Scc-Vi

agro-forestry and the County government were rated very low at 2.9% and 4.9% respectively (Figure 4.13).

The findings were statistically significant  $\chi^2 = 205.568$ ,  $p < 0.05$ . This means, many of the environmental stakeholders in the region have located their projects in rural areas, thus perceived least in spearheading peri-urban conservation. Organizations that were rated higher such as LVEMPII, Osienala and Kenya forest service, have projects in the rural set-up of

Kajulu hills which is adjacent to the study area; however the ripple effect could have been felt in the area thus their higher rating. Bomans *et al.*, (2010), point out a weakness in spatial policy based on coarse, mono-functional categories, unable to take into account transformations in multiple land uses and related values tied to the rapidly changing urban landscape.



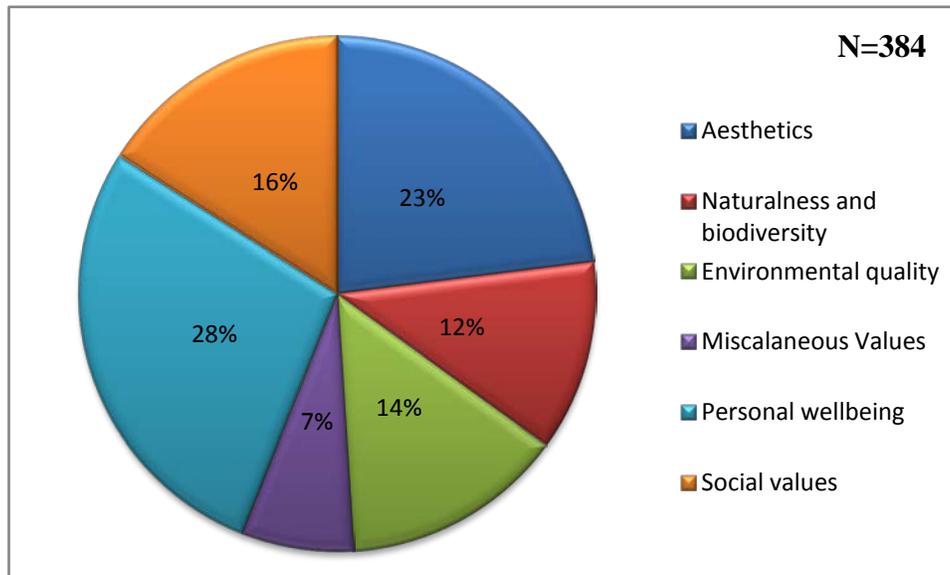
**Figure 3.5: Respondents views on the ability of various environmental stakeholders to spearhead environmental conservation in the area.**

Challenges related to security of tenure in land ownership, spatial planning and the transitional state of the Kajulu-Riat peri-urban, could have been the main obstacle to various organization initiating conservation in the area. According to EEA, 2006, report on ‘peri-urban areas facing sustainability challenges; scenario development in the metropolitan area of Lisbon, peri-urban areas have been traditionally approached from an urban planning perspective as ground for urban sprawl. Agriculture, forestry and natural areas have been neglected in classical spatial planning.

The rapid transformation of peri-urban areas in Africa and their potential to become the new centers of Africa’s urban population presents a new challenge: In the circumstances, the local governments find themselves unable to manage or understand their own growth. analysis of key informant’s data from the City’s environmental department, it was clear that in Kisumu city the design of green area is more focused on “beautification” than on conserving the ecological values as habitats. For most cities, this is an incremental and even ad hoc process that has not delivered a perfect ecosystem management system and the complex thing is that fragmented governance may erode ecological integrity by lack of holistic planning and responsibility (Alfsen-Norodom *et al.*, 2004). Governing ecosystem processes requires coordination across levels of policy, legislation and implementation.

### 3.1.5 Benefits of trees and forests

The study sought to establish respondents understanding on the benefits of trees and forests. This was to comprehend the motivation factors and the benefits for their participation in tree and forest conservation in the study area. The benefits of trees and forest used for this study were selected on the basis of characteristics of ecosystem services by Boyd and Banhaf, 2007; ecosystem services provide benefits that are private goods and those that have open access. Results on motivation factors towards tree and forest conservation showed that “personal well being” was the main factor mentioned by the majority of the respondents (29.7%). Aesthetic value was mentioned by 21.1% of them, followed by social values and environmental quality (Figure 4.14). These were statistically significant different  $\chi^2 = 73.688$ ,  $p < 0.05$ ; which means the trees and shrubs that existed in the study area were mainly for socio-economic and cultural purpose with very little conserved for environmental and biodiversity protection. This suggests powerful synergies between conservation approaches that are often disciplinarily separated, aiming either at human wellbeing or biodiversity conservation. Since different stakeholders perceive different benefits from the same ecosystem processes they can at times be conflicting (Turner, 2003; Hein *et al.*, 2006).



**Figure 3.6: Respondents views on the benefits of tree and plant diversity**

The social value of the benefits that ecosystems provide could potentially be enumerated so that society can make more informed policy and management decisions. These social benefits are termed as ‘nature’s services. According to Obiri and Lawes, (2002), it is difficult to have conservation without some form of protectionism; because conservation through participatory forest management is strongly linked to resource users protecting a resource, by foregoing some benefits from it, in return for other incentives. Personal experience may be important for caring about the protection of nature. However, this study is in agreement with Jim and Chen (2006) study in Guangzhou (China), which found that residents placed high values on services like air quality and aesthetic enhancement in contrast to facilitation of biodiversity, water treatment, and flood abatement, suggesting that they were unable to value what they could not see or had not experienced directly. There are many positive incentives or rationale for having urban forest ecosystems within cities, including environmental, social, and economic values (Nowak *et al.*, 2001). Urban trees are effective in reducing air temperature, increasing air humidity, reducing wind speed, absorbing air pollutants and particulate matter,

reducing carbon dioxide, and reducing noise levels (Streiling and Matzarakis 2003).

**3.1.6 Respondents on various urban priorities such as housing, agriculture, poverty, food, employment, biodiversity, roads**

The study sought to establish some of the various urban priorities according to the respondents, this was important in understanding what the locals consider very important. Water resources had the highest priority (23.4%) followed by housing (18.8%), agriculture (16.7%), while only (5.2%) for tree and plant diversity (Table 4.9). These were statistically significantly different  $\chi^2 = 64.620, p < 0.05$ ; a clear indication of limited interest in peri-urban trees and shrubs conservation. according to (Baker, 2006) this can be attributed to preoccupation with the seemingly more urgent problems of the burgeoning cities such as unemployment, underemployment, crime, pollution, congestion, housing shortages, spontaneous settlements and food supply issues.

**Table 3.2: Response on urban priorities**

The peri-urban socio-economic and environmental needs	Frequency	Percent
Roads	62	16.1
Water	90	23.4
waste management	45	11.7
trees, shrubs and other plant diversity	20	5.2
Trade	31	8.1
Agriculture	64	16.7
Housing	72	18.8
<b>Total</b>	<b>384</b>	<b>100.0</b>

According to (LVSWB,2008), 65% of Kisumu residents had access to improved water sources while 35% relied on unimproved water sources, including water vendors, streams, springs and ponds. Many residents in peri-urban areas use shallow wells located in close proximity to pit latrines thereby increasing chances of cross contamination especially during rainy seasons. This may explain the reason why water had the highest number of respondents as their first priority.

In theory, majority of the respondents in the study are more concerned on how to survive in the city than on environmental conservation. From the analysis of the socio-economic data, majority of the respondents live below the poverty line. Therefore, they are thinking in economic way with their resources/property by changing the use to earn livelihoods from them. The result from the study is a clear indication that conservation of tree and plant biodiversity competes with other socio-economic needs such as housing which degrades the ecologically valuable area. Delivery on economic growth, jobs and housing constructs new pressure on ecologically valuable areas. Several studies suggest that ecosystem services are given a lower priority compared to housing infrastructure, or jobs even if there are strategies in place to protect areas of particular value (Wekerle and Abbruzzese, 2010).

#### IV. CONCLUSIONS AND RECOMMENDATIONS

There is a challenge in the management of conservation strategies in the study area: Poverty and challenges related to land tenure system. There was overdependence on tree and shrub products for socio-economic gains due to limited sources of livelihoods. Sound environmental management strategies lead to communities where people and property are resilient to natural forces, and where the mitigative capacity of natural environmental systems is not diminished.

Peri-urban based conservation approaches should be enhanced. The approaches should focus on dealing with livelihoods and poverty, land subdivision and tenure challenges which are impediments towards initiation of sustainable conservation in peri-urban set-ups.

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# Financial Inclusion in India: Role of RBI

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**Abstract-** The Preamble of the Reserve Bank of India describes the basic functions of the Reserve Bank as:

"...to regulate the issue of Bank Notes and keeping of reserves with a view to securing monetary stability in India and generally to operate the currency and credit system of the country to its advantage.". The paper focus on the role of RBI in financial inclusion in India.

**Index Terms-** Financial inclusion, RBI, ANOVA, liberalisation.

## I. INTRODUCTION

The Government of India and the Reserve Bank of India have been making concerted efforts to promote financial inclusion as one of the important national objectives of the country. Some of the major efforts made in the last five decades including - nationalization of banks, building up of robust branch network of scheduled commercial banks, co-operatives and regional rural banks, introduction of mandated priority sector lending targets, lead bank scheme, formation of self-help groups, permitting BCs/BFs to be appointed by banks to provide door step delivery of banking services, zero balance BSBD accounts, etc. The fundamental objective of all these initiatives is to provide the financial services to the large section of the hitherto financially excluded Indian population. Government of India and RBI have taken various steps to include vast segment of unbanked people in to mainstream banking such as Micro Finance- Self Help Group Model (1992), Kisan Credit Card (1998), No Frill Accounts (2004), Business Correspondents and Business Facilitators (2006, 2009) Swabhimaan (2011) financial inclusion model but the path of financial inclusion is continuous to be challenging. The United Nations (UN) had raised the basic question, "why so many bankable people in rural and urban areas are unbanked?" NSSO data revealed that 45.9 million farmer households in the country (51.4 per cent), out of a total of 89.3 million households do not access credit, either from institutional or non institutional sources. Various financial experts argue that bank account is the most basic step of bringing such people under financial mainstream. So the primary objective of financial inclusion should be to open bank accounts of unbanked people. These people have remained aloof from financial and banking mainstream and they don't possess bank account, don't have knowledge about financial and saving instruments and are unable to reap benefits on whatever large or small amount of money they have at their disposal. In simple language financial inclusion stands for including the people lying on the lowest strata of our social pyramid into the financial mainstream. By financial inclusion, we mean delivery of financial services, including banking services and credit at an affordable cost to the vast sections of disadvantaged and low income groups. The concept

of financial inclusion is not new in India. The concept has been prevailing in India from past 44 years. Beginning with the nationalization of commercial banks in 1969 and 1980, another major step taken was the establishment of Regional Rural Banks in 1975 and banking sector reforms after 1991. As a result of these three major policy changes, the number of branches of commercial bank have increased from 8262 in June 1969 to 102343 in 2013 (Economic survey 2012-2013) and population per branches decline rapidly from 65000 to 13756 (RBI 2008). A large numbers of studies have been made so far on financial inclusion in India, yet some gaps still persist. There are still problems of access to finance; credit, poverty and indebtedness have not been adequately examined. Just to open an account in the bank is not the only solution of the problem. Financial literacy is required for the overall achievement of the objective of financial inclusion. The present study is an attempt to find out of regional disparity, indebtedness and status of financial inclusion in India. Financial inclusion is required to uplift the poor and disadvantaged people by providing them the customized financial products and services. This leads to inclusive growth encompassing the deprived and marginalized sections. This study intends to look at the changes occurred in conditions of India by considering the appropriate variables to test. Back in the 1980's, then Prime Minister Late Shri Rajiv Gandhi stated that of every one rupee spent on development only 15 paise reach the poor. Reserve Bank of India set up the Khan Commission in 2004 to look into financial inclusion and the recommendations of the Commission were incorporated into the mid-term review of the policy (2005-06) and urged banks to review their existing practices to align them with the objective of financial inclusion. In 2005, the Planning Commission found that for every rupee the government spends on the Targeted Public Distribution System only 27 paise reaches the poor. However, the progress is far from satisfactory as evidenced by the World Bank Findex Survey (2012). According to the survey findings, only 35 percent of Indian adults had access to a formal bank account and 8 percent borrowed formally. Only 2 percent of adults used an account to receive money from a family member living in another area and 4 percent used an account to receive payment from the Government. The introduction of a universal and targeted public distribution system (PDS), the provision for employment in rural areas through the National Rural Employment Guarantee Scheme (NREGS), the implementation of the project to bring the population under a unique identification number (AADHAR) and the Direct Benefit Transfer (DBT) Scheme in 2013 are the most recent measures by the government to realize inclusive growth targets. The present study attempts to assess the financial inclusion in India and analyses the trends and patterns of economic inequality across Indian states. The basic objective here is to understand the dynamics of growth in the country

which is resulting in regional imbalances and propose measures for alleviating the problem. Efforts have been made to provide financial services, especially credit facilities, to the rural population since the 18th century. Taccavi loans were provided to the poor farmers in order to buy seeds and agricultural implements. The institutionalization of systems for financial inclusion in India began with the establishment of credit cooperatives following the enactment of the Cooperative Credit Societies Act in 1904. After Independence, these efforts were intensified, following the recommendations of the All India Rural Credit Survey Committee of 1954. The expansion of the traditional commercial banks to rural areas commenced with the nationalization of the Imperial Bank of India and its conversion to the State Bank of India in 1955. The nationalization of 14 major commercial banks in 1969 and another six commercial banks in 1980, along with the introduction of the Lead Bank Scheme in 1970, were steps that facilitated rapid expansion of the banking system into „hitherto unbanked areas.“ Regional rural banks (RRBs) were established under the RRBs Act, 1976, to overcome the difficulties faced by commercial banks, like cultural barriers in dealing with rural people and the high costs involved in the setting up of rural branches. In Bangladesh, Micro Finance Institutions (MFIs), particular "Grameen Bank" is playing a very important role to enhance the financial inclusion. RRBs were envisaged as hybrid banks, incorporating the technical competence and professionalism of the commercial banking system with the local field-level knowledge and low-cost structure of the cooperative banking system. The issues of outreach and credit were fundamental and integral to the concept of RRBs. The creation of the National Bank for Agriculture and Rural Development (NABARD) in 1982 was specifically intended to extend credit and financial services to farmers and the rural population. The cooperatives, which had made sufficient in Poverty and exclusion, continue to dominate socio-economic and political discourse in India as they have done over the last six decades in the postindependence period. Poverty reduction has been an important goal of development policy since the inception of planning in India. Various anti-poverty, employment generation and basic services programmes have been in operation for decades in India. The ongoing reforms attach great importance to removal of poverty and to addressing the wide variations across states. Though the Indian economy recorded impressive growth rates until recently, its impact has sadly not fully percolated to the lowest deciles. Despite being one of the ten fastest growing economies of the world, India is still home to one-third of the world's poor. It is widely known that there are pockets of poverty and financial exclusion in both urban and rural areas, particularly among slum-dwellers. As per the Census of India 2001, India had a slum population of 4.26 crore, which constituted 15 per cent of the total urban population. In the rural areas, the common reasons of financial exclusion include non-existence of bank branches in an area, physical distance of the bank from the people, fixed and limited timings of the banks, lack of awareness of advantages of having a bank account, and above all, low income that made it difficult to save. In the case of the urban poor, the reasons are different. There are lots of bank in the urban areas which are not very far away from the slums. Hence, the distance of the bank from the slums cannot be a factor for financial exclusion. Against this background, it

was felt that a study on financial inclusion in India would give important clues to understand the nature, causes and determinants of financial inclusion.

## II. OBJECTIVE

The objective of the study is primarily to study the causes and determinants of financial inclusion in India. Present study is taken up to achieve the following research objectives:

RO1: To study the determinants of financial inclusion in India.

RO2: To assess the regional inequality of financial inclusion in India.

RO3: To evaluate the initiatives taken by the Reserve Bank of India in financial inclusion.

RO4: To study the issues and challenges of implementation of financial inclusion in India.

To attain the first objective, i.e. to study the determinants of financial inclusion in India, the researcher studied the important determinants of financial inclusion which are responsible for inclusive growth of India. To attain the second objective, i.e. to assess the regional inequality of financial inclusion in India, the statistical tool „ANOVA“ is applied. To attain the third objective, i.e. to evaluate the initiatives taken by the Reserve Bank of India in financial inclusion, Reports of Reserve Bank of India and other relevant studies are discussed. To achieve the last objective, i. e. to study the issues and challenges of implementation of financial inclusion in India, various studies has been discussed and suggestions have been made to overcome these problems. A research design is the specification of methods and procedures for acquiring the needed information. Design to be adopted here is descriptive research. It basically seeks to extract information about financial inclusion in India. The present research study is based on secondary data. The data is collected from the different websites, as well as different articles, published by the Reserve Bank of India, Government of India, other institutions, research journals and internet. Data from research projects, books and magazines is also discussed. In order to achieve the objectives of the study, secondary data is collected from the Basic Statistical Return of Scheduled Commercial Banks in India (RBI), RBI Monthly Bulletin and Status of Micro Finance in India (NABARD) etc. The data so collected is analyzed with help of various tools and techniques to fulfill the research objectives. These include ANOVA and Regression Analysis. The use of these techniques at different places has been made in the light of nature and suitability of data available and requirement of analysis. To conduct the statistical techniques, PASW (Predictive Analytics Software) version 19 for windows is used. The first chapter highlights the nature and need of the financial inclusion in the process of inclusive growth and also explains the importance of financial exclusion in India. This chapter also contains an exhaustive review of the existing literature available on the subject. The studies have been presented in chronological order so that the latest studies are presented first followed by the subsequent studies. Research gaps have been identified and a case for the present study has been built in the end. It also defines the statement of problem and research objectives of the present study. It provides insights into the framework to operationalise the research objectives of the

present study. This chapter also outlines the research methodology employed, the way the data for the study has been collected and the statistical tools used for data analysis. The second chapter is focused on the status of financial inclusion in India. The purpose of this chapter is to present an outline of the concept of financial inclusion and its major milestones in India. It also deals with the present scenario of financial inclusion in India. The third chapter discusses the relationship between financial inclusion and economic development of the country with the help of Index of Financial Inclusion and also explores the factors associated with financial inclusion with the help of Regression Analysis. The fourth chapter analyses the trends and patterns of economic inequality across the Indian states. The basic objective here is to understand the dynamics of growth in the country which is resulting in regional imbalances and proposes measures for alleviating the problem. The inter-state inequality in bank branches, credit accounts, saving accounts and credit deposit ratio show a clear picture of regional inequality in India. The fifth chapter critically evaluates the initiatives taken by the Reserve Bank of India for attaining of financial inclusion. The sixth chapter discusses the issues and challenges being faced for achieving a better level of financial inclusion in India. The seventh chapter put forward the conclusion in line of objectives of the study. Over the past five years, Reserve Bank of India, as also other policy makers have resolutely pursued the agenda of financial inclusion and achieved discernible progress in improving access to financial services for the masses. The importance of financial inclusion has been emphatically underlined in the wake of the financial crisis. The crisis has had a significant negative impact on lives of individuals globally. One of the prominent reasons for the crisis was that the financial system was focused on furthering its own interests and lost its linkage to the real sector and with the society at large. The crisis also resulted in a realization that free market forces do not always result in greater efficiency in the financial system, particularly while protecting the interests of the vulnerable sections of society. This is due to the information asymmetry working against these sections, thereby placing them at a severe disadvantage. In wake of the Crisis, therefore, Financial Inclusion has emerged as a policy imperative for inclusive growth in several countries across the globe. However, though much lip service has been paid to Financial Inclusion, the actual progress has remained far from satisfactory. It is regrettable that the entire debate surrounding financial inclusion has generated significant heat and sound, but little light. The Reserve Bank of India (RBI) and the Government of India have been making efforts to increase banking penetration in the country. Notwithstanding various improvements, financial inclusion found a place in the every financial policy of the RBI. The RBI has undertaken number of measures with the objective of attracting the financially excluded population into the structured financial system. In addition to these, some of the other major initiatives taken by RBI and Government are as follows: Opening of No Frills Accounts, Easier Credit facility by introducing a General Purpose Credit Card facility up to Rs.25,000, Simpler 'Know Your Customer' (KYC) procedure, Use of Information Technology, implementation of Business Correspondent (BC) Model and Project Financial Literacy, Financial Literacy and Credit Counseling programme and establishment of Financial

Inclusion Fund. India and UK have established bodies specifically to tackle the issues of financial inclusion, setting ambitious targets. In the UK, the Financial Inclusion Taskforce oversees over £250 million of government spending and measures progress towards targets for delivering banking services, credit and debt advice. The Indian Committee on Financial Inclusion is headed by Sri C. Rangarajan, the Chairman of the Economic Advisory Council to the Indian Prime Minister. India's National Rural Financial Inclusion Plan aims to reach at least 50 per cent, or 56 million, of financially excluded households by 2012 through rural/semi-urban branches of commercial and regional rural banks, with full inclusion to be achieved by 2015. Both India and UK recognize that by encouraging and supporting people to manage their finances, they can reduce the impact of poverty and help families to sustain themselves, start small businesses and allow enterprise to flourish. They realize that excluding those on low incomes from financial services creates a lack of cash flow for poor families, recourse to expensive moneylenders and the inability to save for emergencies such as sickness and poor harvests, or for older age. Around the world, there is more attention than ever to the ways in which access to financial services accelerates progress toward development and the persisting needs we still face. This has spurred a first wave of high-level commitments by governments, international agencies, the private sector, and others to make the vision of financial inclusion a reality. G20 leaders recognized financial inclusion as a cross-cutting issue for development and economic system stability, and included it in work plans. In 2012, 17 countries committed to create cross-sector coordination platforms and national strategies under the G20, and the AFI Maya Declaration has gained over 30 commitments from national regulators and policy makers. Unique partnerships are forming, for example the Better than Cash Alliance brings together private sector, donors and governments to advance the use of digital channels. ASEAN leaders recognized financial inclusion as a key to inclusive and sustained growth for the region, and global standard setters have incorporated financial inclusion considerations into their guidelines for banking regulation and supervision. In India RBI have encouraged banks to adopt a structured and planned approach to financial inclusion with commitment at the highest levels, through preparation of Board approved Financial Inclusion Plans (FIPs). The first phase of Financial Inclusion Plans was implemented over the period 2010-2013. The Reserve Bank has sought to use the Financial Inclusion Plans as the basis for Financial Inclusion initiatives at the bank level. Reserve Bank has put in place a structured, comprehensive monitoring mechanism for evaluating banks' performance against their Financial Inclusion Plans. Annual review meetings are being held with CMDs of banks to ensure top management support and commitment to the Financial Inclusion process. A snapshot of the progress made by banks under the Financial Inclusion Plans (April 2010 – March 2013) for key parameters, during the three year period is as under:

- Nearly 2, 68, 000 banking outlets have been set up in villages as on March 13 as against 67,694 banking outlets in villages in March 2010
- About 7400 rural branches opened during this period
- Nearly 109 million Basic Savings Bank Deposit Accounts (BSBDAs) have been added, taking the total no. of BSBDAs to

182 million. Share of ICT based accounts have increased substantially – Percentage of ICT accounts to total BSBDAs has increased from 25percent in March 10 to 45percent in March 13

- With the addition of nearly 9.48 million farm sector households during this period, 33.8 million households have been provided with small entrepreneurial credit as at the end of March 2013

- With the addition of nearly 2.25 million non farm sector households during this period, 3.6 million households have been provided with small entrepreneurial credit as at the end of March 2013.

- About 4904 lakh transactions have been carried out in ICT based accounts through BCs during the three year period

It is important to analyze this progress against some disconcerting trends that were noticed in the run up to the structured Financial Inclusion initiatives that the banks launched since 2010 onwards. First, the number of banked centres in the country between 1991 and 2007 had actually come down (from 35236 to 34471). Second, the number of rural branches during the same period had also declined significantly (from 35206 to 30409). Against this backdrop, the progress made during 2010-13 is certainly remarkable. In order to continue with the process of ensuring access to banking services to the excluded, banks have now been advised to draw up a fresh 3 year Financial Inclusion Plan for the period 2013-16. Banks have also been advised that the FIPs prepared by them are disaggregated and percolated down up to the branch level. The disaggregation of the plans is being done with a view to ensure involvement of bank staff across the hierarchy, in the FI efforts and also to ensure uniformity in the reporting structure under the Financial Inclusion Plan. The focus is also now more on the volume of transactions in new accounts opened as a part of the financial inclusion drive. Trends and patterns of economic inequality across Indian states are analyzed. Dynamics of growth in the country are discussed which is resulting in regional imbalances and propose measures for alleviating the problem. The inter-state inequality in bank branches, credit accounts, saving accounts and credit deposit ratio show a clear picture of regional inequality in India. Financial inclusion is a flagship programme of the Reserve Bank. Its objective is to bring people, hitherto excluded, under the ambit of formal financial institutions. To push towards universal financial inclusion, the Reserve Bank has taken several initiatives. These include advising banks on devising their Financial Inclusion Plan and constituting a Financial Inclusion Advisory Committee (FIAC). The Committee, under the Chairmanship of Dr. K.C. Chakrabarty, is helping banks to develop a viable and sustainable model of banking services that focuses on accessible and affordable financial services. To sensitize financially illiterate people, financial literacy programmes have been initiated by the Reserve Bank in collaboration with commercial banks. Opening multiple channels of credit delivery is expected to improve access to institutional credit for excluded people, which, in turn, may help bring them within the ambit of the growth process.

Financial inclusion policy comprises the following:

- i) No Frills Accounts
- ii) Simplification of KYC norms

- iii) Use of Intermediaries
- iv) Introduction of General Credit Cards
- v) Use of Technology
- vi) Use of Regional Language
- vii) One-time Settlement
- viii) Financial Education

### **Initiatives of RBI for Financial Inclusion**

To help the underprivileged participating in the economic development and country's inclusive growth, following initiatives were undertaken by the Reserve Bank of India over the last four decades:

#### **Initiatives taken during 1960s and 1970s**

Focus on increasing credit to the neglected economy and weaker sections of society. Development of the rural banking ecosystem including RRBs, rural and semiurban branches. Implementation of the social contract with banks. Lead Bank Scheme launched for rural lending.

#### **Initiatives taken during 1980s and 1990s**

Branch licensing policy to focus on expansion of commercial bank branches in rural areas. Establishment of National Bank for Agriculture and Rural Development (NABARD) to provide refinance to banks providing credit to agriculture. SHG-Bank Linkage Program launched by NABARD.

#### **Initiatives taken during 2000s**

The term 'Financial Inclusion' was introduced for the first time in RBI's Annual Policy Statement for 2005- 06 and a policy namely "Financial Inclusion Policy" was framed. 100 percent financial inclusion drive launched. Restrictions on ATMs deployment removed.

The Reserve Bank has taken various steps to intensify the credit delivery mechanism and financial inclusion by changing the guidelines for priority sector lending and trying to bring excluded people from both rural and urban areas under the coverage of institutional finance. It is impossible to think about inclusive growth without access to formal finance at an affordable cost. In order to provide credit to the productive sector, which has the potential for employment generation, the Reserve Bank has taken a host of measures including revising the priority sector lending guidelines, which have been in existence since the 1970s. Apart from providing credit under this scheme, the Reserve Bank has adopted a policy of providing credit through multiple channels, viz. involving self-help groups (SHGs) and microfinance institutions (MFIs), expanding the scope of the business correspondence (BC) model, simplifying procedures and processes for micro and small enterprises (MSEs) and adopting information and communication technology (ICT) solutions for greater outreach and lower transaction costs. i) Opening of No-Frills accounts ii) Bouquet of Financial services iii) Engaging Business Correspondents iv) Use of Technology v) Relaxation of KYC Norms vi) Simplified Branch Authorization vii) Opening of branches in unbanked rural centres viii) Roadmap for providing Banking Services in unbanked villages with population more than 2000 ix) Direct Benefit Transfer x) Financial Literacy xi) Financial Inclusion Plan of Banks xii)

Robust Institutional Mechanism xiii) Road Ahead Extending the frontiers of the formal financial system

### **RBI Strategies for Financial Inclusion**

The strategies that need to be adopted for financial inclusion are as follows:

i) Policy measures ii) Making financial services simple, hassle-free and affordable iii) Creating a conducive climate for lending iv) Use of innovative products

### **III. SUGGESTION**

Following suggestions should be adopted to frame the way forward to meet the dream of Financial Inclusion:

i) New Bank Licenses ii) Business and Delivery Model iii) Usage of banking services iv) Financial Education v) Collaborative Efforts vi) Electronic Benefits Transfer (EBT) Steps have been taken by the Government for the expansion of banking services and linking of opportunities among various segments of financial sector like capital markets, insurance, etc. to achieve its aim of Inclusive Growth. High GDP growth in India, triggered by an open economy has created job opportunities in urban and semiurban India and it will go further into rural India, increasing the potential for growth to vast sections of disadvantaged and low income groups. Taking into account the achievements stated in the study and based on interactions with the stakeholders during our various outreach programmes, as also the feedback received from our meetings with the frontline managers, the various issues need to be discussed and resolved. Addressing financial exclusion requires huge effort and resources, thereby taking a longer time to address these imbalances. Economist assumes that human beings are rational and so would respond to a policy like a rational person. However, Behavioral Science has proved that this has not been the case and humans are shown to be irrational at most times. The behavioral economic experts believe that simple changes can lead to more financial inclusion. Several challenges like large area, cost of small value transactions, weak delivery model, unsuitable products, infrastructure, lack of finances, management support have to be effectively dealt with. The automation of core banking processes with the use of channels such as ATM, IVR based Tele-banking, Internet banking, the banking industry has become more profitable. Banks however, face an uphill task of reaching out to the mass customers in remote areas such as villages. Naxal Movement, low Return-on-Investment (ROI), customer behavior, operating expenses inhibits banks from expansion in rural areas. On the basis of above discussion it may be concluded that despite significant growth of financial sector in India a vast segment of population especially low income groups or underprivileged section of society have not been covered under financial inclusion. Availability of banking services to the entire population without any discrimination is the prime objective of financial inclusion. In India there are many reasons for financial exclusion and it bring many negative effects on individual as well as on the society. The main reason for low financial inclusion are lack of adequate supportive infrastructure, absence of appropriate technology, financial illiteracy, lack of suitable financial products and its inflexibility. The Reserve Bank of India and Government of India has been making many

efforts to increase financial inclusion. The emergence of Self Help Group as financial intermediaries in recent year has raised hopes that excluded people and rural India could be effectively financial linked. The Self Help Group Bank Linkage Programme is playing a very important role in the process of financial inclusion in India. Keeping in view the role of financial inclusion in the process of inclusive growth, its effective expansion is a must. When people become aware of the proper use and benefits of the financial services they start getting themselves associated with the development schemes run by the government and others. This has a positive impact on the process of inclusive growth. Financial inclusion is a necessary condition for inclusive growth and in order to achieve it, we should remove or reduce all regional imbalance of financial infrastructure. Financial inclusion should be used as a tool for inclusive growth and Banks, and Micro Finance Institutions, and Non Government Organisations can play a simultaneous major role to achieve it. Banks should redesign their business strategies to incorporate specific plans to promote financial inclusion of low income group treating it both as a business opportunity and as a corporate social responsibility. Bank should also ensure wide publicity about their financial products and policies to enhance financial literacy. A series of innovations are making it possible to provide low-cost and convenient financial services to all those who need them. Mobile phones and digital technology are changing how people bank and pay for things, in part by leveraging existing communications infrastructure and retail networks such as stores, airtime agents, post offices, and banks. And financial service institutions are reaching out to clients in new ways, such as through converted trucks with ATMs and tellers that take banking services to remote villages. Financial products for agriculture, health insurance, and others are inspiring scalable solutions through careful design that meet client needs within their local contexts. Governments are encouraging these and other new models through policies that encourage innovation, partnership, and responsible finance. At the same time, new data efforts are enabling countries and service providers to know more about unbanked markets and client needs, and to measure progress against nationally determined targets

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# Speaker Independent Isolated Word Speech to Text Conversion Using Auto Spectral Subtraction for Punjabi Language

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**Abstract-** Speech is one of the important requirements and the well-situated method of communication between people. Real time speech to text is an accurate conversion of uttered words after speaking. STT is very useful tool to interact with people in counselling interviews or conference. Thus the conversion of speech to written language must be accurate and fast so that it can be easily understood by people. The fundamental approach of this paper is to develop an algorithm to convert speech to text using Punjabi phonetics. This paper introduces and discusses two popular and different noise reduction techniques (Auto Spectral Subtraction, LBG, MFCC) and presents our simulation result of a noise reduction system. It is shown that the system reduces the noise almost completely by finding the minimum Euclidean distance and keeps the enhanced speech signal very similar to the original speech signal. This paper presents a method to design a speech to text conversion module using JAVA. This method is simple to use and takes less use of memory space.

**IndexTerms-** AutoSpectralSubtraction, LindeBuzoGrayalgorithm, Mel Frequency Cepstral Coefficient.

## I. INTRODUCTION

Speech is the most important form of communication in everyday life in order to make the interaction easier and faster. Speech is the vocalized form of human communication and it is considered to be the primary mode of communication among human being and also the most natural and efficient form of exchanging information among human in speech. Automatic Speech Recognition provides a path for natural communication between man and machine. A simple alternative to a hardware interface is a software interface i.e. a Speech to Text system. Speech to Text Conversion or Speech Recognition allows a computer to identify the words that a person speaks into a mike or any other similar hardware and convert it into written words. Basically, the mode of communication between humans takes place in several ways such as facial expressions, gestures, eye contact and speech. Speech to text conversion is very advantageous and used in various applications areas. Human interact with each other in several ways such as facial expression, eye contact, gesture, mainly speech. The speech is primary mode of communication among human being and also the most natural and efficient form of exchanging information among human in speech. The recognition of speech is one the most challenges in speech processing. Speech Recognition can be defined as the process of converting speech signal to a sequence of words by

means of Algorithm implemented as a computer program. Speech to text conversion (STT) system is distinguished into two types, such as speaker dependent and speaker independent systems. The main difficulties in implementation of an ASR system are due to different speaking styles of human beings and environmental disturbances. So the main aim of an ASR system is to transform a speech signal into text message independent of the device, speaker or the surroundings in an accurate and efficient manner.

On the basis of way to recognize speech recognition may be Isolated word recognizes utterance to have quiet on both side of sample windows i.e. only one word at a time and word is preceded and followed by silence. This is having "Listen and Non Listen state". Connected word system are same as isolated words but recognizes speech having one or more than one word and these words are divided or separated by small sound to be "run together minimum pause between them. Continuous speech recognizers allows user to talk almost naturally. Thus system recognizes more than one word and words are connected without any silence.

Spontaneous Word speech Recognition: This system recognizes speech that is natural sounding and not be rehearsed. An ASR System with impulsive speech should be able to handle a dissimilar words and mixture of natural speech feature such as words being run together like ums, ahs and others. Motive of Spontaneous Word Speech Recognition is to recognize natural speech.

This paper gives a description of implementation of Speech to Text Conversion System using Auto Spectral technique. The system goes through different steps to accomplish the task of speech to text conversion that are signal preparation, acoustical analysis, Training and Testing. For the purpose of improving accuracy of the system, the system uses a noise reduction technique named Auto Spectral Subtraction. Auto Spectral Subtraction [8] is a simple and efficient noise reduction technique. In this technique, an average signal spectrum and average noise spectrum are estimated in parts of the recording and subtracted from each other, so that average signal-to-noise ratio (SNR) is improved.

The algorithm for the design of optimal VQ is commonly referred to as the Linde-Buzo-Gray (LBG) algorithm, and it is based on minimization of the squared-error measure.

## II. RELATED WORK

This section of paper will represent literature review of the works which is similar to the presented work.

An implementation of the Punjabi Speech to text system for connected words has been discussed by Mohit Dua[1]. Hidden Markov model toolkit (HTK) has been used to develop the system. A Java platform based Graphical User Interface (GUI) has been developed to make the system fast and user friendly. The implemented system performs well with Word Recognition Rate (WR) 95.8% and 95.4%, Word Accuracy Rate (WA) 94.1% and 91.6% and Word Error Rate (WER) 5.9% and 8.35% in class room and open environment respectively. The recognition results show that the system performs well with different speakers and in different environments.

Wiqas Ghai analysed Automatic Speech Recognition(ASR) for Indo-Aryan languages and the applicability of techniques applied for other languages so that a concrete work can be initiated for Punjabi language[2]. To enhance the performance standards set for other languages, it has been observed that use of techniques Cooperative Heterogeneous ANN Architecture, Maximum Likelihood Linear Regression, Extended MFCC and Learning Vector quantization are helping the researchers to get improved recognition performance of speech recognition systems. So far the work done for Punjabi language is Isolated word speech recognition using Acoustic template matching technique on MATLAB.

Hidden Markov Model (HMM) based Punjabi text to speech synthesis system is presented by Divya Bansal[3] in which speech waveform is generated from Hidden Markov Models themselves, and applies it to Punjabi speech synthesis using the general speech synthesis architecture of HTK (HMM Tool Kit). The developed Text-to-Speech was trained in phase -I on 17 samples with total 61 words all starting with letter ਙ and ਟ and tested for selection of appropriate phoneme sequence on 30 Punjabi words in test 1 and trained for 23 samples containing 81 words containing ਞ and ਞ and tested for 45 selected words in corresponding test-1. Hidden Markov Model Text-to-Speech system approach is very effective for developing Text-to-Speech systems for various languages and can easily implement changes in voice characteristics of synthesized speech with the help of speaker adaptation technique developed for speech recognition. In order to improve efficiency, context-dependent phone models used for synthesis need to be improvised by recording, annotating more Punjabi speech data and applying filters using custom rules/ procedures.

Prachi Khilari gives an overview of major technological perspective and appreciation of the fundamental progress of speech to text conversion and also gives overview technique developed in each stage of classification[4]. A comparative study of different technique is done as per stages and attempts to analyze an approach for designing an efficient system for speech recognition. The development of existing STT system is presented by adding spellchecker module to it for different language. A database has been created from the various domain words and syllables. The desired speech is produced by the Concatenative speech synthesis approach. The system gives the

input data from mice in the form of voice, then preprocessed that data & converted into text format displayed on PC. The user types the input string and the system reads it from the database or data store where the words, phones, diaphones, triphone are stored.

This Speech- to-Text conversion system is implemented by Prasanthi using the MFCC for feature extraction and HMM as the recognizers. The system is also used to find the disorder rate of persons affected with Parkinson's disease by calculating the efficiency of pronunciation[5]. In audio folder, 105 audio files are recorded and these are analyzed to get feature vectors. These features are initially modeling in the HMM. Then, the test spoken word is addressed by Baum-welch algorithm of HMM. From the simulation results, it can be clearly seen that the average recognition rate of 97.14% is achieved by the number of states (N=3).

Noise Reduction Technique (Auto Spectral Subtraction) has been applied by Karun Verma[6] that improves the accuracy of the system to some extent. This paper clearly gives the comparison of the system at two different aspects. One when no noise reduction technique is applied and other when noise reduction technique is applied. HMM Based Speaker Independent Isolated Word Speech to Text Conversion System is developed. The accuracy obtained in the system is still not 100% accurate. To improve the accuracy, different noise compensation/speech enhancements techniques can be used to make the system more accurate. Accuracy of the system also depends on training process of the system.

Marc[8] analyzed noise removal from noisy speeches. The study includes methods for removing noise from noisy speeches using spectral subtraction. Noisy speech was digitally generated by corrupting the data of the clean speech "Real graph" with the data of the vacuum cleaner noise. The approximation of the noise was obtained by taking the average magnitude of the noise spectrum during non-speech activity. The average magnitude of the noise spectrum during non-speech activity was subtracted from the noisy speech spectrum during speech activity. Our initial noise removal design consisted of no frame averaging with half-overlapped data buffers and 256 points Hamming time windows. Results showed that using any combination of half-overlapped and one-fourth-overlapped data buffers with 128, 256, and 512 points, Hamming windows and three frames or six frames averaging did not improve the performance of the denoising algorithm. However, using one-fourth-overlapped data buffers with 256 points Hamming windows and no frames averaging resulted in the greatest improvement differential SNR in the amount of 0.3371 dB, leading to most noise removal from the noisy speech "Real graph". Thus the goal of denoising noisy speech signals has been successfully achieved.

## III. METHODOLOGY

### 1. System Description

The speech to text system is implemented using JAVA for noise reduction. Various techniques has been discussed for natural language processing. Fig 1 shows the GUI interface where there are two phases, one is training (initial step) and other is testing. In training panel, Spectral Subtraction method is used to filter out the acoustic noise. In testing phase speech file is

converted to text using Mel Frequency Cepstral Coefficients and Linde-Buzo-Gray algorithm.

The user first create dataset according to its speech signal and save it in train folder. After that noise from signal is removed and create its spectrogram. We find minimum Euclidean distance between training and testing samples to obtain final results as text.

Thus the whole paper is presented by step to steps and gives apparent approach to text punjabi speech to text.

## 2. Database Preparation

Database is prepared by collecting data having distinct words that is Punjabi counting. 101-200 words have been taken for preparing of dataset. Database preparation involves two steps that is recording of speech files and then labeling of that speech files. In second set of data, Database preparation involves three steps in which first two steps are same as that of first set and third step is noise reduction in speech files.

## 3. Noise Reduction in Speech files

Noise reduction does not affect quality of speech. It only just lowers the intensity of noise. The system uses converter that allows transformations of many files at a same time. The system also adds speech files to converter to perform noise reduction. After adding the speech files used for database preparation to converter, the system adds command Noise Reduction (Auto Spectral Subtraction). Then converter performs noise reduction technique that is Auto Spectral Subtraction on the speech.

## 4. Acoustical Analysis

In Acoustical Analysis, the obtained speech files are represented in more efficient way by extracting features of speech

files. The system uses the Mel Frequency Cepstral Coefficients (MFCCs) to extract features from speech files.

## 5. Training

After calculating the MFCCs, training phase compute vector quantization using Linde Buzo algorithm to train the sound files and save the dataset in train folder.

## 6. Testing

The System is tested for both sets of data used in database preparation. In testing phase, Euclidean distance is calculated and the final results are obtained from which speech is converted to text.

## IV. FLOWCHART OF PROPOSED WORK

The flowchart shown in figure 1 shows the step by step procedure of the proposed work.

1. To study and analyze various techniques for natural language processing.
2. To apply Auto spectral Subtraction for filtering acoustic noise. An average signal spectrum and average noise spectrum are estimated in parts of the recording and subtracted from each other, so that average signal-to-noise ratio (SNR) is improved.
3. To apply Mel Frequency Cepstral coefficient and vector quantization on using Linde-Buzo-Gray algorithm for training the sound files. The algorithm for the design of optimal VQ is commonly referred to as the Linde-Buzo-Gray (LBG) algorithm, and it is based on minimization of the squared-error measure.
4. To perform testing based on Euclidean distance and compute the final results.

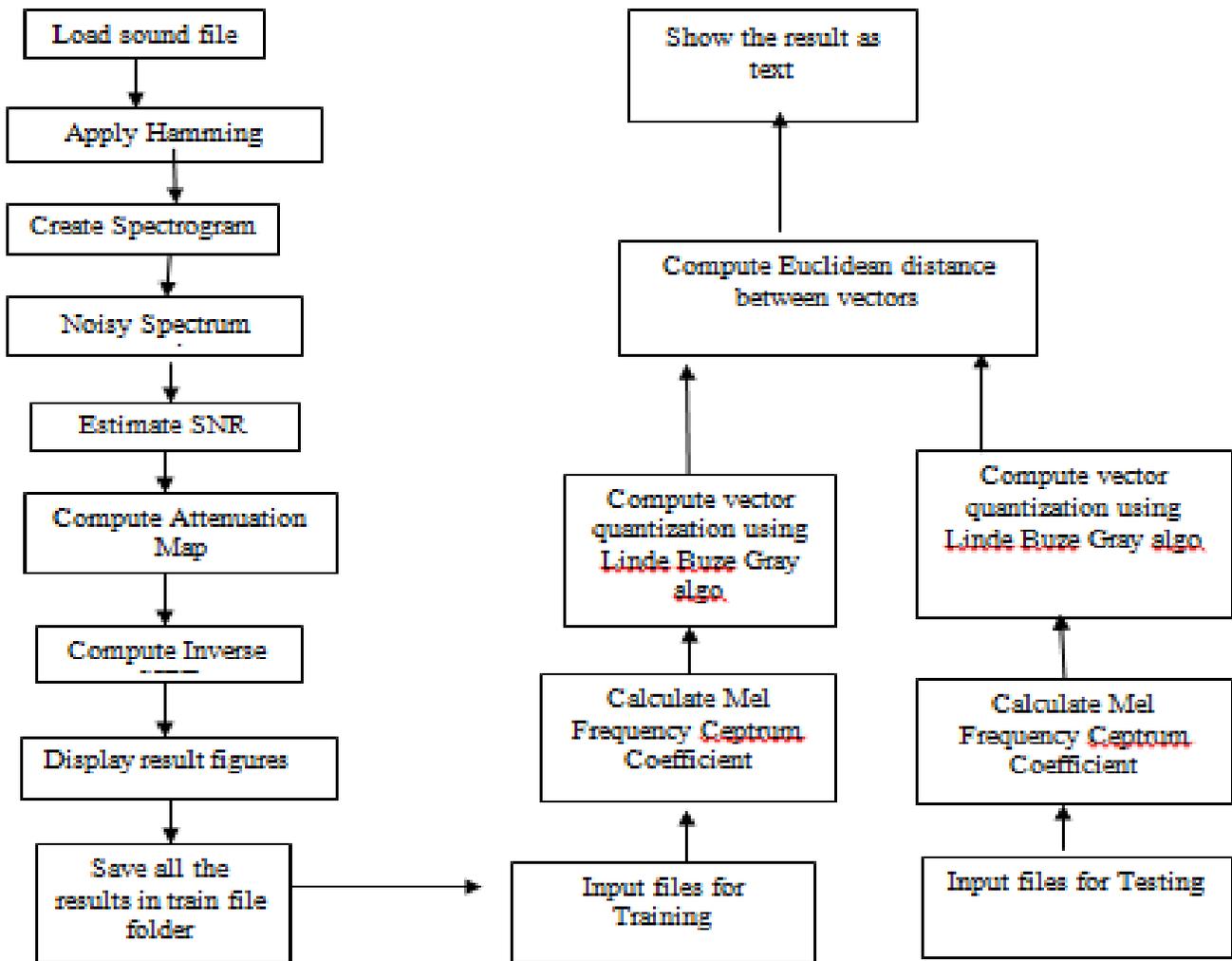


Fig.1 Flow Chart

## V.RESULTS

Figure 1 shows the GUI interface of speech to text converter.

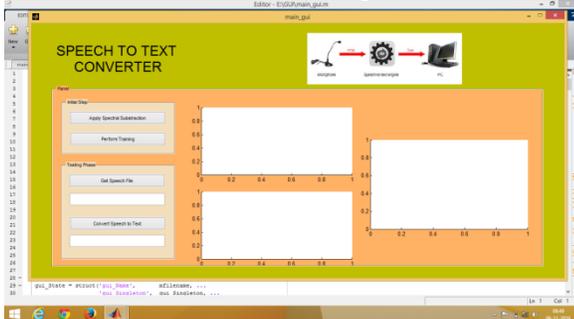
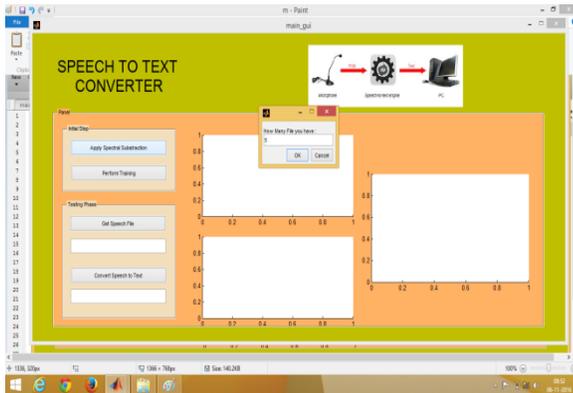


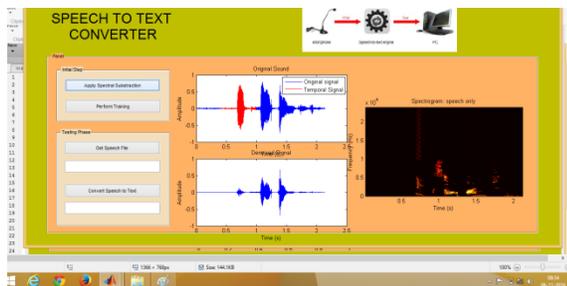
Fig 1. GUI Interface

**Figure 2 results in Auto Spectral Subtraction has been applied for training panel.**



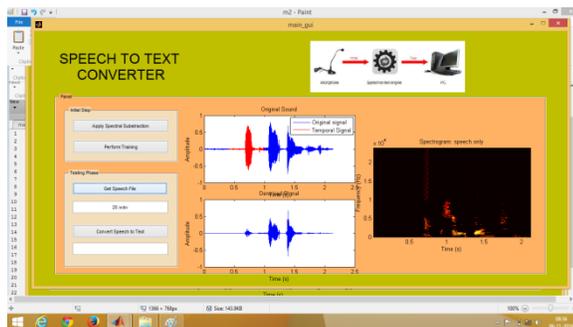
**Fig 2. Apply Spectral Subtraction**

**Figure 3 shows the result of training phase.**



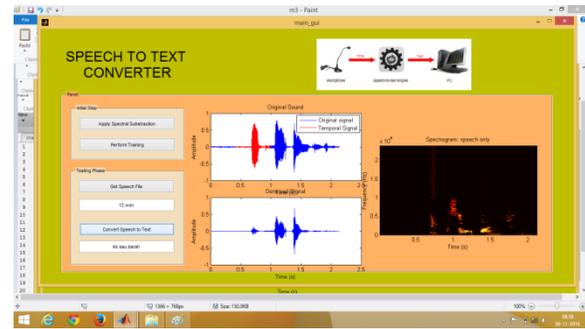
**Fig 3. Result**

**Figure 4 shows the speech file and the result of speech file.**



**Fig 4. Get speech file and Result**

**The final result is shown in figure 5 in which speech is converted to text.**



**Fig 5. Convert speech to text and result**

## V. CONCLUSION

In this paper, we developed an algorithm to convert real time punjabi speech signal to text. This system has many applications, it can be used by dumb and deaf to interact with other persons from society. Speech to text conversion area comes under NLP and human interface. In this paper we use different methods to make it an efficient system. We first use Auto Spectral subtraction to filter out acoustic noise and then we apply Mel Vector quantization using Linde-Buzo-Gray algorithm to perform training and testing of real time punjabi speech files according to user.

The concept not only help physically handicapped challenged people like deaf, dumb and blind but also help speakers in classrooms, conference halls and parliament to make record of their speech in text format. This paper gives clear approach to text punjabi speech to text in step by step procedure. The user first create dataset according to its speech signal and save it in train folder. After that we remove noise from signal and create its spectrogram. We find minimum Euclidean distance between training and testing samples to obtain final results as text.

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# An Assessment of the Contribution of Tax on Nigeria's Economic Development and its Effects on Companies' Performance in Nigeria

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## Introduction

A Tax is a fee charged or levied by a Government on a product, income, or activity. It is levied on individuals or on goods or services, and then it is called an indirect tax. The main reason for taxation is to finance government expenditure and to redistribute wealth which translates to financing development of the country (Ola, 2001, Bhartia, 2009). The study of the relationship between tax incentives and the performance of the firms, has known a peak during these last decades, mainly with the works of Yonah (2006) and Gurria (2009). As a tool of government policy, tax incentives can be adopted to attract investors who want to increase the profitability of their businesses to promote investment, foster growth and survival of the company. The effect of corporate taxes on performance of companies is one of the central questions in both public finance and development. The manufacturing sector of any economy is considered to be very important as its contribution to the growth of the economy reflects visibly in job creation and improved tax contribution. The liberalization of the Nigerian economy through various home grown and other supporting international policy prescriptions over the past decades changed the structure of the manufacturing sector in Nigeria. The challenges of the manufacturing sector come in a midst of high corporate tax rates.

The puzzle on hand is whether it is the high income tax rates that deter foreign direct investment to the manufacturing sector or low import duties create the incentive for investors to import rather than manufacture locally? Whichever way, taxation, observably, plays a role in the misfortunes of the sector because tax policies, apart from generating revenue for the state, serve several other purposes. It can be used as an avenue to protect infant industries, create incentive for investors to invest in certain areas of the economy or to create disincentive for other activities (Ali-Nakyee, 2008). A tax policy defines the cost structure of firms as it is factored into pricing (Nnadi&Akpomi 2007). Governments, over the years, have made pronouncements and policies that are supposed to create tax incentives for businesses.

Fortunately, most of the provisions are to help manufacturing companies to withstand adverse external development. The government of Nigeria over the years has accepted the fact that

taxes have serious effect on the performance of manufacturing companies to retain earnings. It is from this backdrop that the corporate income tax rates have evolved variously from as high as 45% and to 30% currently. Aside the reduction in corporate tax rates, tax policies have provided several reliefs and tax rebates that manufacturing companies can take advantage of. For instance, manufacturing companies export processing zones enjoy a 100 percent tax rebate, while those situated in other regions do not enjoy any relief. Concessionary rates are also available for manufacturing companies that export substantial portions of their products. These reliefs, rebates, and concessions are expected to influence the investment decisions, growth, and ultimate performance of companies. Notwithstanding, manufacturing companies raise several issues on the country's tax policies.

There is a general perception that the flat corporate tax rate is not vertically equitable. According to the manufacturers, the flat corporate tax rate does not favour small manufacturing companies. In buttressing this argument, the manufacturing companies compare the flat corporate tax rate with the progressive personal income tax rates. Indeed, Adam Smith mentioned that, equity as one of the characteristics of a good tax system. The study on the effect corporate income tax on the financial performance of the manufacturing sector is important for at least two reasons. Firstly, a negative impact on manufacturing defeats governments' commitment to restore the past glory of the manufacturing sector. Secondly, a negative impact of tax on the manufacturing firms has implication for job creation and poverty alleviation.

The study of the relationship between taxation and the performance of the firms and its associated problems cannot be over emphasized. However, the effect of corporate taxes on performance of companies is one of the central questions in both public finance and development. The challenges of the manufacturing sector come amidst of high corporate tax rates. Whichever way, taxation, observably, plays a role in the misfortunes of the sector because tax policies, apart from generating revenue for the state, serve several other purposes. It can be used as an avenue to protect infant industries, create incentive for investors to invest in certain areas of the economy or to create disincentive for other activities. The

pronouncements made by governments, over the years have created tax incentives for businesses.

The Taxes and resultant policies seem to have serious effect on the solvency, profitability, and other indicators of performance of manufacturing companies. Many authors have studied various aspect of the taxation and tax policies, some of which are: Unegbu and Ireferin, 2011 Ola (2001), Ayodele (2004) Jhingan, (2004), Musgrave and Musgrave (2004), Bhartia (2009), Yonah (2006), Gurria (2009), Ali-Nakyea (2008), Nnadi&Akpomi (2007), Barro (1991), DeLong and Summers (1991), Baumol, Litan, and Schramm (2007), Starting with Jorgenson (1963) Hall and Jorgenson (1967), However, this study on the effect of corporate income tax on the performance of the companies' is unique and the first time it will be undertaken and is important for at least two reasons. Firstly, a negative impact on manufacturing defeats governments' commitment to restore the past glory of the manufacturing sector. Secondly, a negative impact of tax on the manufacturing firms has implication for job creation and poverty alleviation. In order to address these issues the following pertinent questions would be necessary to answer: what effect does corporate tax have on the profitability, solvency, efficiency, dividends and earnings per share of companies in Nigeria? As the main aim of the paper the study seeks to assess the effects of corporate taxation on companies' performance in some companies in Nigeria and specifically the paper looked in to these variables.

Far more important the findings from this paper will invariably be useful to stakeholders in tax management and administration and will enable corporations ascertain the effect of taxation on their profitability and growth. It will also provide competitors, investors and stakeholders to ascertain the company performance and implication of tax on the company generally. Furthermore, the results of this paper add new knowledge to the ones existing in the field, stimulate interest for further investigation thereby expanding the frontier of knowledge in the discipline.

The study is confined to six companies and examines the financial reports for the company for a period of five years. The companies include; Dangote Group Plc, John Holt Plc, United Africa Company of Nigeria Plc, Nigerian Bottling Company Ltd, Unilever Nigeria Plc. The justification for the choice of these companies and period of assessment is to ensure broader horizon for the acceptability of the study conclusions.

## **Empirical Review**

### **The Concept of Tax**

Taxation, like any other accounting concept, has been described in so many ways. Ayodele (2004) and Iyere (1998) view tax as a compulsory levy imposed by the government on its people or organizations so that it can achieve some objectives. Bhatia (2001) goes further to argue that the compulsory levy imposed by government is not accompanied by any definite reward to the people from the government. However, Dandago and Alabede (2000) are of the view that tax is compulsory levy and that its

imposition is aimed at raising money toward defraying the expenditure of the government. A Tax is a fee charged or levied by a Government on a product, income, or activity. If it is levied directly on personal or corporate income, it is called a direct tax. If it is levied on the price of a good or service, then it is called an indirect tax. The main reason for taxation is to finance Government expenditure and to redistribute wealth which translates to financing development of the country (Ola, 2001, Jhingan, 2004, Musgrave and Musgrave, 2004, Bhartia, 2009). The study of the relationship between tax incentives and the performance of the firms, has known a peak during these last decades, mainly with the works of Yonah (2006) and Gurria (2009). As a tool of government policy, tax incentives can be adopted to attract investors who want to increase the profitability of their businesses to promote investment, foster growth and survival of the company. The effect of corporate taxes on performance of companies is one of the central questions in both public finance and development. This effect matters not only for the evaluation and design of tax policy, but also for thinking about economic growth (Barro 1991, DeLong and Summers 1991, and Baumol, Litan, and Schramm 2007). Starting with Jorgenson (1963) and Hall and Jorgenson (1967), many public finance economists and accountants have addressed this topic. A small selection of important studies includes Summers (1981), Feldstein, Dicks-Mireaux and Poterba (1983), Auerbach (1983), King and Fullerton (1984), Slemrod (1990), Auerbach and Hassett (1992), Hines and Rice (1994), Cummins, Hassett, and Hubbard (1996), Devereux, Griffith, and Klemm (2002), and Desai, Foley, and Hines (2004b). Auerbach (2002), Gordon and Hines (2002), asset and Hubbard (2002), and Hines (2005) survey aspects of this literature. Arising from the foregone concepts, tax can therefore be defined as a levy imposed by the government on the incomes of its people and organizations with the aim to achieving some economic goals.

### **Purpose of Taxation**

Tax is basically imposed to achieve two main purposes: revenue generation and management of the economy (Ayodele, 2004). However, Buhari (1993), Dandago (2000), Oji (1998) identified the following as the specific objectives of taxation. Include among others: Revenue Generation: Income Distribution: Economic Growth and Development: Protection of Infant Industries: Stabilization of the Economy: Foreign Exchange Management: Modification of Investment Pattern.

### **Classification of Tax**

There are many ways of classifying tax. Ayodele (2004) suggested three basic ways. These are: According to Incidence: This is adopted when taking into consideration the person or the entity that bears the final burden of the tax. Under this approach, tax can either be direct or indirect. The former is a tax on income or property whose burden cannot be shifted. The latter, on the other hand, are taxes on consumption or production of certain good, and services in which the burden is shifted to the final consumer. According to Bases: This is based on the object on which that tax is levied. It can be, for example, Personnel Income Tax (PIT), Companies Income Tax (CIT),

Petroleum Profit Tax (PPT), Capital Gains Tax (CGT), Value Added Tax (VAT), Excise Duty, and Custom Duty. According to Rates: This is based on the variation in tax rates as a proportion of tax base. They are progressive tax, proportional tax, and regressive tax. Proportional where the same rates are paid irrespective of the level of income earned, progressive while the tax rate increases as the income increases and regressive where the rate reduces as the size of income increases.

The economic effects of taxation according to (Ayodele, 2004) include: Effect on Production: If taxes on excise duties are high, production costs will be high and this affects production adversely.

Effect on Saving: When taxes are high, the disposable income of individuals will be low and people go for consumption rather than savings. Effect on Investment: Where tax is high, it discourages investment as the amount of money in the hand of tax payer is depleted. Effect on Consumption: The higher the tax the lower the consumption and vice versa.

### **Taxation and its Contribution to Economic Development of Nigeria**

Whether the taxes collected are enough to finance the development of the country will depend on the needs of the country and, countries can seek alternative sources of revenue to finance sustainable development (Unegbu and Ireferin, 2011). Tax revenue is the receipt from tax structures.

Revenues accruing to an economy, such as Nigeria, can be divided into two main categories, which are; Oil Revenue (includes revenue from royalties, Petroleum Profit Tax (PPT), gas tax) and Non-Oil revenue (includes trade, loans, direct and indirect taxes paid by other sectors of the economy, Aids, agriculture etc). However, tax revenue mobilization as a source of financing developmental activities in less developed economies has been a difficult issue primarily because of various forms of resistance, such as evasion, avoidance corrupt practices attending to it.

These activities are considered as sabotaging the economy and are readily presented as reasons for the underdevelopment of the country. Government collects taxes in order to provide an efficient and steadily expanding non-revenue yielding services, such as infrastructure-education, health, communications system etc, employment opportunities and essential public services (such as the maintenance of laws and order) irrespective of the prevailing ideology or the political system of a particular nation. Tax is also the nexus between state and its citizens, and tax revenues are the lifeblood of the social contract. The very act of taxation has profoundly beneficial effects in fostering better and more accountable government (Tax Justice Network (TJN), 2012). Musgrave and Musgrave (2004) also stated that the economic effects of tax include micro effects on the distribution of income and efficiency of resource use as well as macro effect on the level of capacity output, employment, prices, and growth.

However, the use of tax as an instrument of fiscal policy to achieve economic growth in most less developed countries cannot be reliable because of dwindling level of revenue generation.

Consequent upon this, changing or fine-tuning tax rates has been used to influence or achieve macroeconomic stability. A critical examples of governments that have influenced their economic development through revenue from tax are; Canada, United States, Netherland, United Kingdom. They derive substantial revenue from Company Income tax, Value Added Tax, Import Duties and have used same to create prosperity (Oluba 2008).

A significant share of the tax revenue increase in Africa stems from natural resource taxes. This included income from production sharing, royalties, and corporate income tax on oil and mining companies (Pfister, 2009). Nigeria is a developing country whose major export is mainly crude oil. Also endowed with other natural resources such as; natural gas, tin, iron ore, coal, limestone, lead, zinc and arable land (Economy Watch, 2011). As a sovereign nation, Nigeria has a land mass that covers about 923, 768 sq km and have a population of about 149,229,090. According to Tran (2008), emerging economies are nations that have large territories and populations, and they are undertaking extraordinary development projects that call for new infrastructure, such as power-generating plants and telecommunications systems. Also, United Nations (2005) asserts that, achieving the Millennium Development Goals (MDGs), for instance, low-income countries (LICs) are required to increase their domestic revenues by around 4 percent of the GDP. Also, to meet the MDGs, OECD countries have been urged to raise their level of aid to LICs to about 0.7 percent of their Gross National Income – but this is as nothing when compared to potential tax revenues. The infrastructural developments demand a lot of resources and funding. In many rich countries, tax constitutes 30-40 percent of the GDP (Golit, 2008 and TJN, 2012).

Nigeria with a budget of N4.97 trillion for the year 2011, representing 12% increase of 2010 annual budget (Unegbu and Ireferin, 2011) shows that tax revenue is one of the ways of funding infrastructural developments specified in the budget. The tax base in Nigeria since had been on the increase in order to mobilize the resources needed to execute infrastructural projects. According to Kaldor (1963), those who believe that insufficient growth and investment is mainly a consequence of a lack of resources are chiefly concerned with increasing the resources available for investment through additional taxation. The availability and mobilization of revenue is the fundamental factor on which an economic development is sustained and managed. As noted by TJN (2012), tax is the most important, the most beneficial, and the most sustainable source of finance for development.

Tax revenue in Africa, for example, is worth ten times the value of foreign aid. The long-term goal of poor countries must be to replace foreign aid dependency with tax self-reliance. However, in Nigeria the contribution of tax revenue has not been encouraging, thus expectations of government are being cut short. Corruption, evasion, avoidance and tax haven indicators are strongly associated with low revenue (Attila, Chambas, and Combes, 2008) and indeed, corruption functions like a tax itself. According to Adegbe and Fakile, (2011), the more citizens lack knowledge or education about taxation in the country, the

greater the desire and the opportunities for tax evasion, avoidance and non-compliance with relevant tax laws. In this respect, the country will be more adversely affected because of absence of tax conscience on the part of individuals and the companies and the failure of tax administration to recognize the importance of communication and dialogue between the government and the citizens in matters relating to taxation.

In the face of resource deficiency in financing long term development, Nigeria has heavily resorted to foreign capital, such loans and aid as the primary means to achieve rapid economic growth. Thereby accumulate huge external debt in relation to gross domestic product and serious debt servicing problems in terms of foreign exchange flow and, as such majority of the populace live in abject poverty. Government as expressed concern over these and has vowed to expand the tax revenue in order to meeting its mandate. Kiabel and Nwokah (2009) argue that the increasing cost of running government coupled with the dwindling revenue has left all tiers of government in Nigeria with formulating strategies to improve the revenue base. Also, Ndekwu (1991) noted that, more than ever before, there is now a great demand for the optimization of revenue from various tax sources in Nigeria. This probably influenced the decision of the Federal Government of Nigeria (FGN), which in 1991 set up a Study Group on the Review of the Nigerian Tax System and Administration.

Also, that an accurate estimation of the optimal level of expenditure requires knowledge of the productivity of the tax system and that it will assist in identifying a sustainable revenue profile for the country. As noted by IMF (cited in TJN, 2012) : "Developing countries must be able to raise the revenues required to finance the services demanded by their citizens and the infrastructure (physical and social) that will enable them to move out of poverty. Taxation will play the key role in this revenue mobilization. . . .

As a means of meeting their expenditure requirements, many developing countries undertook tax reforms in the 1980s. However, most of these reforms focused on tax structure rather than on tax administration geared towards generating more revenue from existing tax sources (Osoro, 1991).

There are very few studies which have been conducted to see the impact of tax revenue on economic development. Some of the relevant related studies with regard to the subject matter were reviewed below. Expert of group United Nations (2000) stated that, tax revenue contributes substantially to development and therefore, there is the need to streamline a nation tax system so as to ensure the realization of optimal tax revenue through equitable and fair distribution of the tax burden. The stark reality in most developing countries is that whilst there is severe budgetary pressure as a result of ever increasing demand for government expenditure, there is a limited scope for raising extra tax revenues, as a result of Non-compliance with corporate persons result from technicalities and tax avoidance, poor record keeping and cash transactions. Keen and Mansour (2010), in analyzing the revenue mobilization in sub-Saharan-Africa found that, within sub-Saharan Africa, revenue has performed more

strongly in resource-rich countries. In the same Desai, Foley and Hines (2004) stated that governments have at their disposal many tax instruments that can be used to finance their activities. These tax alternatives include personal and corporate income taxes, sales taxes, value added taxes, capital gain taxes and others. It is not uncommon for a country to impose all of these taxes simultaneously. Contrarily, in choosing what tax instruments to use and what rates to impose, governments are typically influenced by their expectations of the effects of taxation on investment and economic activity, including foreign direct investment (FDI). They stated that there is extensive empirical study that high corporate income tax rates are associated with low levels of FDI.

On the issue of the problem of tax revenue instability Lim (1983) in his study, instability of government revenue and expenditure in less developed countries observed that tax revenues instability was the major cause of expenditure instability in less developed countries in the period going from 1965 to 1973. Bleaney, Gemmel and Greenaway (1995) also, in their study, tax revenue instability, with particular reference to sub-Saharan Africa analyzed the sources and the consequences of revenues instability in developing countries. They found that tax revenue instability is more common in poor, more open and more inflationary economies. And evidence that countries with high tax revenue instability tend also to have high total expenditure instability. In line with this, Ebeke and Ehrhart (2010) in their work, the sources and consequences of the instability of tax revenue in Sub-Saharan African countries, using panel for 39 countries over the period 1980-2005, gave credence to Bleaney, Gemmel and Greenaway (1995), Guillaumont et al (1999), Fatas and Mihov, (2003), Talvi and Vegh (2005), Furceri (2007), Loayza et al (2007), Thorthon (2008) and Diallo (2009), that tax revenues instability in Sub-Saharan Africa is leading to public investment and government consumption instability which in turn generates lower public investment ratio and is therefore detrimental to the long term economic growth.

This is of deep concern for Sub-Saharan African countries since it was found to be detrimental for growth and welfare. Owolabi and Okwu (2011) examined the contribution of Value Added Tax to Development of Lagos State Economy, using simple regression models as abstractions of the respective sectors considered in the study. The study considered a vector of development indicators as dependent variables and regressed each on VAT revenue proceeds to Lagos State for the study period. Development aspects considered included infrastructural development, environmental management, education sector development, youth and social development, agricultural sector development, health sector development and transportation sector development. The results showed that VAT revenue contributed positively to the development of the respective sectors. However, the positive contribution was statistically significant only in agricultural sector development. On the aggregate, the analysis showed that VAT revenue had considerable contribution to development of the economy during the study period. Also Unegbu and Irefin (2011) in their paper, the impact of value added tax (VAT) on economic and

human developments of emerging Nations from 2001 to 2009, found out that VAT allocations have a very significant impact on expenditure pattern of the state during the same period.

Also observed that, the perceptions by the citizenry across the administrative areas of the state suggest that VAT has minimum impact level on the economic and human developments of Adamawa State from 2001 to 2009. Adegbe and Fakile (2011) concentrated on the Company Income Tax and Nigeria Economic Development relationship concluded that there is a significant relationship between company income tax and Nigerian economic development. And that tax evasion and avoidance are major hindrances to revenue generation.

Lee and Gordon (2004) in their paper, Tax structure and economic growth, explore how tax policies affect a country's growth rate, using cross-country data during 1970–1997. Their findings revealed that statutory corporate tax rates are significantly negatively correlated with cross-sectional differences in average economic growth rates, controlling for various other determinants of economic growth, and other standard tax variables. And also, that in fixed-effect regressions increases in corporate tax rates lead to lower future growth rates within countries.

Ogbonna and Ebimobowei (2012) examined the Impact of Tax Reforms and Economic Growth of Nigeria using relevant descriptive statistics and econometric analysis and concluded that the various test shows that tax reforms is positively and significantly related to economic growth and that tax reforms granger cause economic growth. Also, that tax reforms improves the revenue generating machinery of government to undertake socially desirable expenditure that will translate to economic growth in real output and per capita basis.

The few literatures that exist are of the support that tax revenue impact positively on economic growth. However, the reviewed studies ignored the link between tax revenue and economic growth and provided evidence that may not provide an adequate guide for policy decisions. Also, most of the previous studies applied techniques that take into no account of the properties of the time series that were used in their analysis and possibly arriving at unrealistic estimates. Ogbonna and Ebimobowei (2012) so far represent the most comprehensive assessment of the impact tax revenue on economic growth. In his he disaggregated tax revenue into its various components such as; excise duties, personal income tax, petroleum profit tax, company's income tax, value added tax and education tax.

Many countries impose corporate tax, also called corporation tax or company tax, on the income or capital of some types of legal entities. A similar tax may be imposed at state or lower levels. The taxes may also be referred to as income tax or capital tax. Entities treated as partnerships are generally not taxed at the entity level. Most countries tax all corporations doing business in the country on income from that country. Many countries tax all income of corporations organized in the country.

Company income subject to tax is often determined much like taxable income for individuals. Generally, the tax is imposed on

net profits. In some jurisdictions, rules for taxing companies may differ significantly from rules for taxing individuals. Certain corporate acts, like reorganizations, may not be taxed. Some types of entities may be exempt from tax.

### **Effect of Corporate Income Taxes on Company's Performance**

Corporate taxes can be expected to reduce investment by firms as they increase the user cost of capital. In addition, they can be expected to reduce TFP growth for a number of reasons. First, as with labour taxes, corporate taxes can distort relative factor prices resulting in a re-allocation of 11 resources towards possibly less productive sectors (e.g. the non-corporate sector) which may lower total factor productivity (Boersch-Supan, 1998). Second, complex corporate tax codes can cause high tax compliance costs for firms and high administrative burdens for governments, which absorb resources that could be used for productive activities, causing productivity and efficiency losses. Third, high corporate taxes may reduce incentives to invest in innovative activities by reducing their after-tax return. Fourth, to the extent that corporate taxes reduce FDI and the presence of foreign multinational enterprises they can hinder technology transfers and knowledge spill-overs to domestic firms. In order to test the impact on investment and TFP, empirical evidence was obtained from both firm-level data covering a sample of 14 European OECD countries and industry-level data covering 21 industries in 16 OECD countries. *Investment* The empirical results, both at firm and industry level, assessing the effect of taxes on investment were obtained by introducing the tax adjusted user cost in a standard investment equation with adjustment costs of capital (see Schweltnus and Arnold, 2008 and Vartia, 2008 for details). In addition to the standard user cost components (the required rate of return to the investment, the economic depreciation rate and anticipated capital gain/loss due to a change in before-tax price of the asset) the tax-adjusted user cost takes into account taxes on profits and the present value of the tax savings from depreciation allowances. The industry-specific user cost is constructed as a weighted average of the asset specific user cost where the weights are the share of each asset in total industry investment. The main empirical findings at the firm-level are summarised in Table 3 (see Schweltnus and Arnold, 2008 for details). Column 1 shows that increases in the tax-adjusted user cost of capital are found to reduce investment at the firm-level, while column 2 shows that this effect is larger for more profitable firms. A simulation experiment suggests that a reduction of the statutory corporate tax rate from 35% to 30% reduces the user cost by approximately 2.8%. Applying the estimated long-run tax adjusted user cost elasticity (from column 1), this implies a long-run increase of the investment-to-capital ratio of approximately 1.9%.

### **Theoretical background**

An extensive literature has produced convincing results concerning the impact of tax incentives on the investment. Stiglitz (1973), Sandmo (1974), King (1974) and Boadway (1979) have extended the Jorgenson's classical model

of investment behavior (1967) to determine the effects of taxation on investment decisions. By emphasizing the importance of tax policy and administration for domestic and international investors, Stone (2008) proceeds by comparing the advantages and disadvantages of tax incentives, he said that taxation affects the international competitiveness. By treating the relationship between fiscal policy and financial policy within the firm and its impact on growth, Strulik (2003) conducted by comparing the policies of firms in different economic contexts.

The impacts identified by the author are obtained by using a general equilibrium model based on production functions of Cobb Douglas, detailing the account of the firm (based on investment, employment, result operation ...). The results found by the author shows that a reduction of 10% tax would increase the firm gain of 5%. The author stresses that the standard models (not taking into account the economy as a whole) overestimate the effect of the tax reform on investment and profitability since they neglect the financial adjustments of the company. Jochen A. Birk (2006), using statistics provided by a number of OECD countries argue that tax reform can reduce unemployment and improve economic growth by improving the financial performance of the firm.

Tax incentives are a stimulating factor of the location of foreign direct investors. Through a survey by questionnaire on a sample of 600 executives of large multinational firms from seven countries including Hongkong Singapore, Australia, Canada, PR China, U.S. and UK, Simmons (2003) showed that there is a significant positive correlation between indices of the attractiveness of the tax system of countries selected and the size entries of FDI. However, in a turbulent economic environment characterized by multiple mutations, the company is increasingly facing a tougher competitive space, due to the enlargement of its scope of activities and the interconnectedness of different markets.

To adapt to this environment and cope with this competition, the company must be able to free the various economic and strategic challenges to ensure its sustainability, among other things is to be competitive and improve its economic and financial performance. In the world of management science, reflections on the performance have been the source of many questions. Indeed, Lebas (1995b) considers that "there is no universal and comprehensive definition of performance and yet every business must define the term for its internal and external communication." Moreover, the criteria for evaluating performance contribute to the lack of a universal definition. Indeed, in the 60s, the measure of performance was the size (sales, assets). Then in the 70s, it is called net income or earnings per share to evaluate performance. Later in the 80s, the performance evaluation is done through the company's ability to generate liquidity. Recently, it equates to the performance ability to create value. So when it comes to measuring performance, economists tend to use the benefit as this measure allows the component to impregnate and "creativity" (the income component) and component "discipline" (component cost) necessary to follow a market economy. Relative to income, the measure of performance is more cost effective to the extent that

costs are more stable. Frydman (1999) argues that it is the measure most used by managers who can form an idea on costs and the costs that the firm will bear. Clearly, tax is a heavy cost to the company wishing to reduce its expenses. Reduce the tax will obviously reduce business costs which can improve its financial performance. Several criteria and indicators are used to measure the performance of exporting firms.

The multitude of them clearly demonstrates the consensus on the multidimensional nature of the concept of performance. From an analysis of relevant literature of the last twenty years, Dennis (1990) distinguishes between two approaches to measurement: a quantitative approach using criteria that measure the size of exports and a second approach using qualitative criteria that measure the perception of success in foreign markets. In the same vein, Ramangalahy (2002) reports three categories of indicators must be taken to determine the performance of exporting firms: quantitative indicators measuring the export performance and qualitative indicators measuring the strategic performance of companies. The first criteria for evaluating performance emerges from the literature namely, the financial criteria such as profitability, solvency and liquidity... it is important to note that traditional measures are no longer adapted to the current context where competition has taken on new forms (quality, time, ...). This failure in financial systems for measuring the performance was highlighted by several studies. In 1995, Lebas argues that it is impossible to reduce the performance of the company to the only the information provided by the operating income or net book value (NBV) because it is the result of a sequence operations.

The financial measures reflect the results of measures taken in the past (Kaplan and Norton (2001), Shank and Govindarajan (1995), etc.). Therefore, financial measures haven't a proactive quality and do not indicate how to improve performance. Thus, financial measures do not take into account the intangible asset so that currently, the value of the company is increasingly explained by other factors such as innovation, personnel, quality, certification, etc. The exclusive use of financial performance measures has spawned a large gap in the systems of performance measurement. The non-financial measures were introduced to implement the missing piece of the puzzle of performance. These measures have proved a great contribution in evaluating the performance of the company. Indeed, Ittner and Larcker (2003) consider that the main objective of non-financial performance is to complete the picture provided by the traditional financial information. They show that non-financial measures of performance are numerous. Firstly, quality is now the ultimate weapon and the underlying foundation of the performance of competitive firms. It may be regarded as a product of the excellence compared to current market alternatives. Then stocks can be considered as non-financial measures to the extent that poor inventory management can affect the value of the firm. Indeed, the JIT can avoid the high costs of storage through rigorous coordination with suppliers.

Then, productivity reflects the non-financial aspect and it measures the ratio of outputs produced in relation to inputs consumed. This concept is generally used to characterize

the efficiency that means the ability of a firm to produce at lower cost. Moreover, innovation (flexibility) is considered the engine of value creation as firms are constantly seeking sources of differentiation through innovation work in succession. Delivery times are also an indicator of non-financial performance since the delivery reliability is critical for customers. Finally, skills and attitudes of the company personnel are performance indicators relevant to the extent that the operation of the business relies on human capital.

## Summary and Conclusions

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# The Impact of Street Begging on the Freetown Municipality

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**Abstract-** This paper attempts to examine the social impact of street begging on Freetown Municipality. A cross – sectional study conducted among 100 respondents composed 70 beggars, 20 members of the focus group discussions and 10 key informants. Data was collected involving quantitative and qualitative approaches were used for data collection. Simple descriptive statistics were used for analyzing the data. The realized consequences of street begging were abusive languages from the public, harassments from municipal officials and police, harassment from fellow beggars, and sexual abuse, accident, etc were reported. It was recommended that to get rid of begging were getting capital to start small businesses, getting care giver for themselves and their children, getting employment and getting accommodation.

**Index Terms-** Street begging, consequences, future aspirations, begging life, beggars

## I. INTRODUCTION

Begging in the streets of urban areas is one of the age-long activities and perhaps occupations of the highly vulnerable, poverty-ridden individuals in the society of both developed and developing countries. Although the problem of begging is a worldwide phenomenon, it is more pronounced in developing countries” (Jelili, 2013; Namwata *et al.*, 2012). Wikipedia (2010) and Mortimer (2005) defined street begging “as asking for money, food, shelter or other things from people they encounter by request without an exchange of service in a public place”. Olawale (2007) “regarded alms begging as the habit of a beggar soliciting for favour from passers-by for survival and enrichment”. Many authors (Namwata *et al.*, 2012; Demewozu, 2005; and Demewozu, 2003) have argued that the “beggary problem has a lot to do with the country’s socioeconomic and historical aspects characterized by low incomes, high unemployment rates, fast rising cost of living, high rates of population growth, inappropriate public policies, continued rural-urban migration and displacement of mass human beings to the city”. Thus, the cardinal reasons for most of the different vulnerable categories of beggars to earn a meager living on the streets, churchyards and other collective quarters of the city is poverty precipitated by different factors and events. The beggars, as impoverished underclass, presently find themselves in multifaceted and extreme impoverishments which can generally be characterized by chronic food shortage and insecurity, illiteracy, homelessness or poor housing often on unsuitable land,

disease, in sanitary living conditions, death and above all marginalization and exclusion.

Mortimer (2005) asserts that “the consequences of begging include sexual harassment of female beggars, being driven from one location to another, exposure to raw weather, fear of being captured for sacrifice are reported by the subject themselves”. Eyo, Usoro and Usoro (2007) cited in Yusuf *et al.* (2012) viewed “street begging as a national malady that eats into the fabrics of social, economic, religious, political and educational structures”

## II. LITERATURE REVIEW

### 2.1. Socio –economic and demographic characteristics of beggars

According to the theory of culture of poverty indicates that “poverty as a subculture passes from one generation to another and becomes institutionalized in the poor some characteristics which prepares the ground for the phenomenon of begging”.

Demewozu, (2005). Some of these characteristics are:

1. Non participation in public activities
2. Low level of associations and lack of voluntary associations
3. Felling of anonymity in the urban society, social isolation and tendency towards hermitage.
4. Suffering from some chronic illnesses and sometime malingering
5. Lack of professional skills.
6. Experiencing long-term unemployment periods
7. “Existence of some spiritual and psychological characteristics such as low self- esteem; weak self – concept; self- esteem tendency towards indolence, lack of cognitive psyche; feeling of incapability; dependence on others and the feeling of unworthiness” Anna (2014):

Begging develops in societies where there is no appropriate job for the people with a special profession or skill and the society can’t effectively solve the problems of the poor. However there are mentalities and values dominating the society which consider the poor’s low level of life as the result of their own incapability. In such conditions, begging is both a means for adaptation to the environment to survive and a reaction which the poor individual reveals against his/ her feeling of unworthiness in order to resist hopelessness. Hopelessness results from knowing the reality that achieving success in terms of the values and goals of the larger society is impossible for them. “Every human society has witnessed the phenomena of street begging at one time or the other and has lingered on over

time” Wilson (2009:11). “With some, it died away in others or it is at its barest minimum depending on the circumstances of starting the begging which could be as a result of human or natural disasters; in form of wars, famine, flood or earthquakes which dispossess people of their livelihood- do compel some surviving victims to engage in a temporary but often dehumanizing begging with a view to keeping body and soul together” Ferguson et al (2009:11

According to Ahamdi (2010), “begging is a social problem which has not only psychological consequences such as the development of inferiority complex in the beggars’ family members and their network of kinship, but also problem of begging will affect , as an unpleasant problem, but also the geographical and social structure of the urban areas”. Foyoh (2013) asserts that “nowadays, in Freetown, poverty and societal changes resulting from urbanization have produced more emotional and pressing social problems, of which begging is the most serious and a visible one”. As such, “begging, an almost unnoticed social event and problem, has become the means of livelihood for quite a large number of persons. It is a common and day-to-day experience for us to observe beggars of different sorts roaming around the streets, squatting on major church environs, swarming here and there”. According to Kamanda (2014), sociologists developed theories to explain social phenomena like street begging, such as vicious circle of poverty and functionalist.

## 2.2. Begging and its related concept in modern times

The trend and dynamics of begging in prevalence within most parts of the human society is aged old and thus have generated lots of concerns by social thinkers who have proffered lots of controversies as to its pervasiveness and dynamics Michelle, (2007). “Begging among many social maladies is viewed to be an attitude of nuisance projected by those engaged in it to their targeted members of the public” Adams, (2004). According to Roberts (2010:), “among certain people of both poor and of able bodied categories who sees the act of pan-handling as a career motivated in him by a once elderly relative or neighbor”. While Murray (2008), views “begging as a social act of exploitation by both the giver and the recipient who seek to promote it as a motivational means for the survival of such easy going members of the society”.

“For most countries of the third world, begging as an indication of abject poverty, has always been a major way out for the helpless poor” Adedibu, (2008). However, not all beggars are poor or motivated into begging by poverty, and not all the poor are beggars. This, therefore, necessitates the need to re-examine the concept of begging and related issues. To beg, simply means to ask for money, food, clothes, etc, as a gift or as charity. This implies that begging is not peculiar to individuals, but also organizations or countries. For the latter group, it is conceptualized here as “corporate begging”; and it is made to include seeking for charity by organizations or grants or debts cancellation by richer organizations or nations to poorer organizations or nations. The former category, which is the concern of this study, is synonymous with street and house-to-house begging; it borders around such issues or related concepts as “panhandling” “mendicancy” and “vagrancy” which characterize city beggars. This conceptualization would not only

capture the image of the begging and begging question, but also reflect their implications for the city’s physical and socio-economic environment.

## 2.3 Religious Perspectives on Begging

Religion by most social construct is described as a way of life whose ideology is transferred from one generation to another. Depending on the background of some religions, but most conventional ones, begging is an accepted phenomenon by, and for its practitioners Abdullah, (2001). That is to say, “in virtually every religion of the world issues surrounding alms giving (and by implication begging) are entrenched though with different approaches”. In this section the issue of alms giving and begging as obtained in the scriptures of both Islam and Christianity (which are the two most popular orthodox religions) is examined. In Islam, “zakat” (alms giving) is so weighty that it is one of the five pillars of the religion. Thus says Allah: “And in their properties there was the right of the beggar, and the Mahruum” (the poor). It is believed that every “penny” spent for the poor is spent for the cause of Almighty Allah.

It is evident in the Koran, and of course, Islam, not to reject beggars “And reject not the beggar” (Koran 93, verse10). The list of those entitled to alms in Islam is not, however, restricted to beggars, but including all the poor, the captives, those in debt, stranded travelers, among many others. (Koran 9 verse 60). In summary while giving alms is seriously encouraged, begging is not frowned at, if the need arises. In Christianity, alms giving is also encouraged but begging is silent upon. Thus says the Bible: “Oh the joys of those who are kind to the poor (are that) the Lord rescues them in times of trouble” Psalm (41:1). “Whoever gives to the poor will lack nothing. But a course will come upon those who close their eyes to poverty Proverbs ( 28:27).

## 2.4. Identify the categories of street beggars and their feelings about begging life in Freetown

The human society is a very complex entity encompassing people from various socio-economic and political backgrounds with series of activities. Roberts, in ‘Power and Money, a social myrage’, (2001), posited that, “Since the beginning of time, medieval and onto the modern centuries, there have been the sick, poor, marginalized, less privileged etc among others engaging in begging and or relying on the asking for alms for their survival”. According to Daniels, (2013) one of the most degrading, “psychologically damaging and thus worst of life’s endeavour is street or street pan-handling, which is common almost in every human society. Indeed begging is shameful and degrading as supported by Beatrice, (2012) but added that, it is not just about its emotionally degrading impact it can have on the individual, but rather the reaction of the society to street beggars”.

Mason (2011) “identified three categories of beggars in urban areas thus; those (children or adults) who lead disabled or sick parents or relatives, those who beg entirely on their own; and those who act as front for parents, especially mothers who are usually hidden from public view but supervise them from distance”. “These children or adults as beggars come from the poorest of the poor families, sleep in streets or with their accompanying adults in spontaneous beggars’ colonies in cities”. “These beggars are exposed to high risk of accidents in heavy

traffic when they beg, constant abuse and aggression from general public, being co-opted into dubious criminal acts, such as steeling, pick pocketing, drug abuse/peddling, homosexuality, errand boys and girls, prostitution and so many other vices prevalent in the society” Annual Report, Human Right Commission of Sierra Leone( 2014). for improving their condition and leaving this occupation. At the Freetown Municipality level, various employments generating programme is evolved to solve the problem of unemployment, proper supply of water, availability of electricity, sanitation. Other measures being suggested by them to uplift their socio-economic status are dwelling place, below poverty line card

### III. RESEARCH METHODOLOGY

#### 3.1. Introduction

This chapter includes a discussion of the following major areas: (a) research design, (b) study area, (c) population (d) Sampling frame (e) Sampling techniques (f) sample size (g) research instrument (h) data collection and sources of data, (e) data processing and analysis, (f) summary of chapter. The first section of the chapter, research design, provides a description and rationale for choosing quantitative research; specifically, it speaks on the questionnaire approaches for the study. The data collection and sources of data section addresses the study’s data sources and procedures. The data analysis and interpretation section gives a detailed description of the data analysis and interpretation processes the research will use once data are collected.

#### 3.2. Research Design

“Research design is the arrangement of conditions for collections and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedures” (Kothari, 2004). It constitutes a blue print for the collection, measurement and analysis of the data (ibid). “Research design represent a logical and systematic plan prepared for directing a research study and specifies the objectives of the study, the methodology and techniques to be adopted for achieving objectives of the study” (Krishna swami, 2006). Therefore this study adopted case study design because it led into in depth understanding of the phenomenon.

#### 3.3. Study Area

In 1787 the British helped four hundred freed slaves from the United States, Nova Scotia, and Great Britain returned to Sierra Leone to settle in what they called the ” Province of Freedom.” The area was first settled by freed slaves sent from England around the Cotton Tree which was said to have previously been a slave market. Disease and hostility from the indigenous population nearly eliminated the first group of returnees. This settlement was joined by other groups of freed slaves and soon became known as Freetown. In 1792, Freetown became one of Britain’s first colonies in West Africa. It is the largest city and also capital of Sierra Leone lying on the peninsula near the Atlantic coast and hosts the third largest natural harbour in the world – Elizabeth II Quay.

Thousands of slaves were returned to or liberated in Freetown. Most chose to remain in Sierra Leone. These returned Africans or Creoles – as they came to be called – were from all

areas of Africa. Some of the earliest settlements can be found in the mountain villages of York, Regent, Bathurst, Leicester and Gloucester. From Regent you can walk through creole villages to Charlotte falls and also climb Sugar Loaf Mountain which is one of the highest points on the peninsula. Some fascinating Creole architecture can be found in these areas as well as in downtown Freetown.

Fourah Bay College (pron. frah bay) was established in 1827 in Freetown and rapidly became a magnet for English-speaking Africans on the West Coast. For more than a century, it was the only European-style university in Sub-Saharan Africa. Fourah Bay College (FBC) became known as the “Athens of West Africa” due to a strong focus within its curriculum on learning Greek and Latin and because of the success of its graduates at home and abroad. In addition, FBC attracted students from all over West Africa, particularly British West Africa ( Nigeria, Gambia, and Ghana).

The landscape in Freetown is very hilly and looking similar to other great landscapes for example the San Francisco Bay Area. In Freetown, you can see the sea from almost any point in the city and you are never far away from the beach!

Today, Freetown is a buzzing capital and is lively by day or by night. In the main city centre and further towards the east is mainly the commercial area although more businesses today are moving towards the west to avoid overcrowding. On a busy day, Freetown echoes with the sound of hooting cars, local traders and passers-by and beggars begging. The west of Freetown is mainly residential and further west (South-West) you will find some of the country’s most beautiful beaches.

The markets in Freetown are colourful and can be noisy as every trader tries to capture your attention, but just like Freetown and Sierra Leone, there’s a certain charm to it. At night, Freetown cries out through the speakers of local night clubs and bars. New York is not the only city that does not sleep! Sierra Leoneans love to have a good time and in Freetown you’re never far away from an entertainment spot.

Some of Freetown’s attractions famous structures include The Cotton Tree, Freetown Law Courts, the Slave Gate and Portuguese Steps, St John’s Maroon Church (built around 1820), St George’s Cathedral (completed in 1828), Sierra Leone Museum, Foullah Town Mosque (built in the 1830s) ,Sierra Leone Museum (featuring the Ruitter Stone and original drum of Bai Bureh), Victoria Park, Creole and colonial architecture, the lively markets and fantastic beaches

#### 3.3. Population of the Study Area

Population of study is a “group of individuals who have one or common characteristics that are of interest to the researcher” (Best and Khan, 1998). In addition population is “referred as a full set of cases from which a sample is taken” (Saunders, 2007). Therefore, population for this particular study was beggars in the Freetown municipality

#### 3.4. Sampling Frame

The sampling from for this study is from a common meeting held with the mentioned groups during the research since a list or directory to contact them individually from was absent

#### 3.5. Sampling Techniques

Sample “is a segment of population in which the researcher is interested in gaining information from and drawing

conclusion” (Brian, 1992). In this study the researcher used purposive sampling to select sample for key informants. The researcher used purposive sampling so as to get firsthand information regarding the impact of street begging on the Freetown Municipality. These key informants are the ones who have access of information regarding beggars that are at strategic places.

### 3.6. Sample Size

To obtain the sample size for the study, the researcher selected one hundred (100) women, men and children who are beggars. Thirty (30) were blind beggars of all ages including men and women. Fifty (50) were crippled, five (5) were dumb and fifteen (15) were amputees in Freetown were interviewed in person for this study. Two focus groups of stakeholders working in the disability area from government and civil society organizations (nongovernmental, faith, and community-based organizations and organizations of persons with disabilities) in Freetown were considered for this study. Representatives from government organizations especially National Commission for People with Disabilities were interviewed in the first focus group and representatives from civil society organizations in the second.

### 3.7. Research Instrument

The two key research tools employed to undertake this investigation are interviews, the administration of a structured questionnaire through the use of the random sampling method. The interviews were conducted on a face- to – face basis with the key respondents of the various set of beggars „Since the process was so time consuming and finance demanding the researcher had to find other ways to consult other others. The study area wide and broad that the researcher resorted to the questionnaire in order to solicit more information. The questions used for the interviews were the same used to administer the questionnaire. The questions were prepared that they catered for all respondents.

They were semi – structured interview questions and questionnaires. This is so because they follow less structured procedures. Both opened and closed questions were used in in the questionnaires which: there were also questions that suggested the input of the respondents which may not have been mentioned in the questionnaire. They were however structured that such they maintained and retained the subject matter under investigation.

### 3.8. Data collection and sources of data

The sources of data were primary and secondary as this study was an original study. As indicated earlier a close and open -ended questionnaire for respondents was used as the main instrument to collect data. Personal interviews were conducted with these categories of beggars as mentioned above. The appropriate time for administration was negotiated between the researchers and the respondents. The questionnaire distribution was facilitated by the researcher who also assisted in the collection process. The whole of this exercise was done for a period of two months as some of the respondents were too busy due to mining and farming.

### 3.9. Data Processing and Analysis

Data collected was analyzed qualitatively and quantitatively using the Statistical Packages for Social Sciences (SPSS). Before starting the analysis process, the researchers processed the data by editing, categorizing and coding it appropriately. After processing; the researchers then fed the data into the computer via the SPSS programme.

### 3.10 Ethical Considerations

The study followed the ethical standards for human subject research provided. Respondents were told that participation in the research was voluntary. Respondents were also informed about the confidentiality of the study. They were told that information received from them would be kept confidential and no one else would have access to the study data except the principal investigator. All study respondents were adults’ women and men beggars and hence, there was minimum risk for participation in the study. This information was shared with participants in a written informed consent in English and translated in the local language which is Krio that was read to them before the interviews. To maintain confidentiality, pseudonyms are used in all transcripts and research reports. All audiotapes and other identifying information will be destroyed after the dissertation is completed and articles are published using the data.

### 3.11. Limitations of the Study

In the process of gathering relevant information from respondents for this study, the researcher was faced with limitations. one of it was the distance from where the researcher is residing to locate where the beggars normally beg, the weather situation which must times prevented the researcher from reaching the respondents in terms of heavy rain fall, also must times the beggars were not available at their locations for interviews which makes it difficult to conduct. Another limitation was must beggars were not willing to response to interviews from an unknown person. Another limitation was they were always busy begging and could not afford to response to interviews when they feel no financial will be derived.

## IV. RESULT AND DISCUSSIONS

In order to achieve the objective of this study, the researcher administered a structured questionnaire as the main data collection method. The questionnaire provided rich information derived from descriptions and explanations of events that occurred within a specific subject’s environment. The researcher examined the interview data against the approaches and strategies referred to in the literature review. The analysis is in two sections; demography of respondents and research questions. One hundred and fifty (150) questionnaires were administered, only one hundred (100) were returned filled which makes 66.7% respondent rate.

**Table 4.1 describes Gender of Respondents**

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	40	40.0	40.0	40.0
Female	60	60.0	60.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 60% of the beggars contacted for this was female and 40% were male. It can be concluded more female beggars were contacted as compared to

their male counterpart. The reason is that there are more female beggars both young and old in the street of Freetown

**Table 4.2 describes the Age group of Respondents**

	Frequency	Percent	Valid Percent	Cumulative Percent
0 year - 15 years	10	10.0	10.0	10.0
16 years - 35 years	65	65.0	65.0	75.0
36 years - 64 years	20	20.0	20.0	95.0
65 years and above	5	5.0	5.0	100.0
Total	100	100.0	100.0	

The table above reveals that 10% of the beggars contacted for this study aged between 0 year – 15 years,65% between 16 years – 35 years,20% between 36 years – 64 years and 5% aged 65 years and above. It can be concluded that more of the beggars

contacted for this study are between the ages of 16 years – 35 years. Reason being that these are the abled beggars who normally walk up and down in the street of Freetown

**Table 4.3. describes the Physical Status of Respondents**

	Frequency	Percent	Valid Percent	Cumulative Percent
Blind	30	30.0	30.0	30.0
Crippled	50	50.0	50.0	80.0
Dumb	5	5.0	5.0	85.0
Amputee	15	15.0	15.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 30% of the respondents contacted for this study were blind beggars both male and female, 50% were crippled,5% were dumb and 15% were

amputees. It can be concluded that majority of the respondents contacted were crippled. Reason being they are always seen with wheelchairs along the streets.

**Table 4.4.describes the Marital status of Respondents**

	Frequency	Percent	Valid Percent	Cumulative Percent
Married with children	30	30.0	30.0	30.0
Married without children	5	5.0	5.0	35.0
Single with children	15	15.0	15.0	50.0

Single without children	10	10.0	10.0	60.0
Widow	40	40.0	40.0	100.0
Total	100	100.0	100.0	

The table above reveals that 30% of the respondents contacted for this study were married with children, 5% were married without children, 15% were single with children, 10% were single without children and 40% were widow. It can be

concluded that majority of the respondents contacted were widow. Reason being that, a good number of them claimed to have lost their beloved husbands either during the past rebel war or Ebola outbreak

**Table 4.5. describes the Educational Background of Respondents**

	Frequency	Percent	Valid Percent	Cumulative Percent
Illiterate	40	40.0	40.0	40.0
Primary	30	30.0	30.0	70.0
Secondary	20	20.0	20.0	90.0
Tertiary	10	10.0	10.0	100.0
Total	100	100.0	100.0	

The table above reveals that 40% of the respondents contacted for this study were illiterate, 30% had primary education, 20% had secondary education and 10% had tertiary

education. It can be concluded that more of the respondents contacted were illiterate. Being illiterate has caused them not to be fully employed or acquire skills

**Table 4.6 describe the Ethnicity of Beggars**

	Frequency	Percent	Valid Percent	Cumulative Percent
Temne	60	60.0	60.0	60.0
Mende	5	5.0	5.0	65.0
Limba	10	10.0	10.0	75.0
Loko	15	15.0	15.0	90.0
Others	10	10.0	10.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 60% of the beggars contacted for this study were from the Temne ethnic group, 5% were from the Mende ethnic group, 10% were from the Limba ethnic group, 15% were from the Loko ethnic group and 10% were from others such as Kono, Susu, Madingo etc. It can be concluded that more of the beggars contacted for this study were from the Temne ethnic group. Reason being that Freetown

Municipality is a predominantly Temne settlement from history and even the districts close to Freetown. The proximity to come to Freetown is very high as compared to other ethnic groups like Mende and Kono living far away from Freetown. They could only be seeing begging in their provincial towns like Bo and Kenema.

**Table 4.7. describe the Household size of Respondents**

	Frequency	Percent	Valid Percent	Cumulative Percent
0 - 5	55	55.0	55.0	55.0
5 - 10	35	35.0	35.0	90.0
11 and above	10	10.0	10.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 55% of the respondents contacted for this study household size is between 0 – 5 persons, 35% between 5 – 10 persons and 10% between 11 and above

persons. It can be concluded that majority of the respondents contacted for this study household is between 0 – 5 persons.

**Table 4.8.describe the Level of income earn a day**

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than Le 50,000	30	30.0	30.0	30.0
Le 51,000 - Le 100,000	40	40.0	40.0	70.0
Le 101,000 - Le 150,000	20	20.0	20.0	90.0
Le 151,000 and above	10	10.0	10.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 30% of the respondents contacted for this study earn less than Le 50,000 per day,40% earn between Le 51,000 – Le 100,000 a day,20% earn between Le 101,000 – Le 150,000 a day and 10% earn between Le 151,000 and above. It can be concluded that majority of the

beggars who beg every day in Freetown can earn between Le 51,000 – Le 100,000.Reason being that they are always seeing by vehicles and moving from shop to shop with their begging activities.

**Table 4.9.describe the Residential Status of respondents**

	Frequency	Percent	Valid Percent	Cumulative Percent
Western	20	20.0	20.0	20.0
Central	40	40.0	40.0	60.0
Eastern	30	30.0	30.0	90.0
Others	10	10.0	10.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 20% of the respondents contacted was living in the Western part of Freetown, 40% in the Central part of Freetown, 30% in the Eastern part of Freetown and 10% from others such as Waterloo and Mountain Rural settlements. It can be concluded that majority of the respondents

contacted for this study are living in the Central part of Freetown. Reason being that, there are many slums area within the Central part of Freetown such as Kroo Bay, Magazine Wharf, Susan’s Bay etc.

**Table 4.10 describe How long have you lived here?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 1 year	20	20.0	20.0	20.0
2 years - 15 years	60	60.0	60.0	80.0
16 years - 35 years	15	15.0	15.0	95.0
36 years and above	5	5.0	5.0	100.0
Total	100	100.0	100.0	

The table form above reveals that 20% of the respondents contacted for this study have lived in Freetown less than 1 year,60% have lived between 2 years – 15 years,15% between 16 years – 35 years and 5% 36 years and above. It can be concluded

that majority of the respondents contacted for this study have live in Freetown between 2 years – 15 years. Reason being that, some were born in Freetown and some came as the result of the past rebel war

**Table 4.11 describe the Area of begging in Greater Freetown**

	Frequency	Percent	Valid Percent	Cumulative Percent
West 1	5	5.0	5.0	5.0
West 2	10	10.0	10.0	15.0
West 3	12	12.0	12.0	27.0
Central 1	15	15.0	15.0	42.0
Central 2	30	30.0	30.0	72.0
East 1	11	11.0	11.0	83.0
East 2	10	10.0	10.0	93.0
East 3	7	7.0	7.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 5% of the respondents contacted on the area of begging in greater Freetown were from West 1,10% from West 2,12% from West 3,15 % from Central 1,30% from Central 2,11 % from East 1,10% from East 2 and 7

% from East 3.It can be concluded that majority of the beggars begging in greater Freetown are found normally found in Central 2.Reason being that this area comprise the central busy district which attract many people every day

**Table 4.12 describe What are the causes of begging in Freetown**

	Frequency	Percent	Valid Percent	Cumulative Percent
Poverty	25	25.0	25.0	25.0
Homelessness	35	35.0	35.0	60.0
Unemployment	20	20.0	20.0	80.0
Religious obligations	5	5.0	5.0	85.0
Children's education	8	8.0	8.0	93.0
Treating sickness	4	4.0	4.0	97.0
Family rejection	3	3.0	3.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 25 % of the respondents contacted on what the causes of begging in Freetown are indicated poverty as a good number of people cannot afford a three square meal per day, lack access to many social amenities, good health care service and as a result turn to begging.35% indicated homelessness, so many people have moved from rural area to settle in Freetown where they cannot afford to rent a decent house. They result to living in slums, under big building pillars or veranda, unfinished houses etc.20 % indicated unemployment either in the private or public sectors and they need money to take care of 12them and family.5 % indicated religious obligations as Muslims believe that begging is part of

their religion normally called “Zakat” and Christians referred to it as alms giving. Because of these reasons many beggars are seeing in front of Churches or Mosques especially during this month of fasting.8% indicated children’s education, a good number of poor people want their children to be educated and if they cannot afford sending them to school we normally all of them begging together in the stree.4 % indicated treating sickness as many cannot afford good medical care so they rely on begging and 3 % indicated family rejection must families pay less attention to their parents when they get old and many sit along the street to beg. It be concluded that homelessness plays a major cause of people resulting to begging coupled with poverty.

**Table 4.13 describe What are the negative impacts of street begging on the beggars**

	Frequency	Percent	Valid Percent	Cumulative Percent
Sexual Exploitation	4	4.0	4.0	4.0
Kidnapping	2	2.0	2.0	6.0
Road accident	20	20.0	20.0	26.0
Physical assault	6	6.0	6.0	32.0
Force prostitution	5	5.0	5.0	37.0
Harsh weather	10	10.0	10.0	47.0
Force into crime	3	3.0	3.0	50.0
Abusive languages from members of the public	15	15.0	15.0	65.0
Harassment from Municipal Officials and Police	9	9.0	9.0	74.0
Harassment from fellow beggars	6	6.0	6.0	80.0
Diseases such as Malaria	15	15.0	15.0	95.0
Loss of sight	5	5.0	5.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 4% of the respondents contacted on what are the negative impacts of street begging on beggars indicated sexual exploitation. Meaning a good number of them are being sexually abused as a result of their condition.2% indicated kidnapping which normally occurs in the case of children.20% indicated road accident as many a time these people are knock down by driver since they are either standing on the road or close to the road.6% indicated physical assault as they experience such act from the public in terms of asking them to leave their premises,5 % indicated force prostitution, a good number of them are engaged in the trade to find their living.10% indicated harsh weather especially during the rains where they

lacked proper shelter.3% indicated force into crime such as pick pocketing .15% indicated abusive languages from members of the public, it is a common action where the public abuse them as being lazy.9% indicated harassment form Municipal official and police whenever they want to get rid -off of them.6 % indicated harassment from fellow beggars as they are always seen quarrelling among themselves for money or clothing .15 % indicated diseases such as malaria.it is obvious that their living condition will always expose to them to such diseases and 5 % indicated loss of sight as many of them cannot afford to visit clinic for medication

**Table 4.14 describes What are the positive impacts of street begging on beggars**

	Frequency	Percent	Valid Percent	Cumulative Percent
Income	60	60.0	60.0	60.0
Food	30	30.0	30.0	90.0
Clothing	10	10.0	10.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 60 % of the respondents contacted on what are the positive impacts of street begging on beggars indicated income as many see begging as a source of income for either their daily life or welfare,30% indicated food,

this is one of the basic human needs which beggars are beg for to get every day to feed their families and 10% indicated clothing as a good number are living with tattered clothing would love to appear neat in public

**Table 4.15. describe What are the psychosocial needs of beggars**

	Frequency	Percent	Valid Percent	Cumulative Percent
Accommodation	30	30.0	30.0	30.0
Money	20	20.0	20.0	50.0
Employment	5	5.0	5.0	55.0
Learn trade	20	20.0	20.0	75.0
Health care	15	15.0	15.0	90.0
Children education	10	10.0	10.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 30% of the beggars contacted on what are the psychosocial needs of beggars indicated accommodation as a good number of them are living in slum areas with deplorable conditions.20% indicated money which is the key to everything,5% indicated employment as a good number cannot be meaningfully employ due to their educational background and lacked trade,20% indicated learn

trade which is the wish of abled wheelchair men and women that they want to acquire skills that can make them self- reliance.15% indicated health care as it is difficult to access quality medication due to poverty among other factors.10% indicated children education as they want their children to acquire quality education.

**Table 4.16. describe What are the religious perspectives of begging**

	Frequency	Percent	Valid Percent	Cumulative Percent
Zakat for Muslims	60	60.0	60.0	60.0
Alms Giving for Christians	30	30.0	30.0	90.0
Others	10	10.0	10.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 60 % of the respondents contacted on what are the religious perspectives of begging indicated “Zakat” for Muslims who are with the strong belief that a Muslim give “Zakat” in the form of food, clothing or money to those who cannot afford them.30% indicated Alms giving for Christians as it is done through such organisation called Saint

Vincent De Poor of the Roman Catholic Churches. Members solicit money and used materials from church member and distribute it to the poor when and where necessary.10% indicated others such non-believers are with the notion that begging is just as a result of laziness.

**Table 4.17 describe the Future aspiration for beggars to stop begging activities**

	Frequency	Percent	Valid Percent	Cumulative Percent
If I get job	12	12.0	12.0	12.0
If I get someone to take care of me	10	10.0	10.0	22.0
If I get someone to care of my child	15	15.0	15.0	37.0
If I get capital for doing business	13	13.0	13.0	50.0
If I get where to live or to be accommodated	50	50.0	50.0	100.0

**Table 4.17 describe the Future aspiration for beggars to stop begging activities**

	Frequency	Percent	Valid Percent	Cumulative Percent
If I get job	12	12.0	12.0	12.0
If I get someone to take care of me	10	10.0	10.0	22.0
If I get someone to care of my child	15	15.0	15.0	37.0
If I get capital for doing business	13	13.0	13.0	50.0
If I get where to live or to be accommodated	50	50.0	50.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 12 % of the respondents contacted on the future aspiration for beggars to stop begging activities indicated if I get job meaning he or she if gainfully employ begging will be of the past to him or her.10% indicated if I get someone to take care of me as many elderly men and women are seeing begging because they lack someone to take

care of them.15% indicated if I get someone to take care of my child, some are with children without fathers and find it difficult to take care of them.13 % indicated if I get capital for doing business, many hope to be engaged into petty businesses but lack the starting capital and 50 % indicated if I get where to live or to be accommodated

**Table 4.18. describe the Ways the city authorities/central government and other developmental partners can stop street begging in Freetown**

	Frequency	Percent	Valid Percent	Cumulative Percent
Legislation to mitigate unemployment, improve employability and self-reliance	20	20.0	20.0	20.0
Government must make hard decisions in order to rid society of indiscipline and corruption, and outline measures to stop begging on our streets	30	30.0	30.0	50.0
More shelters for homeless should be opened where training in various crafts and trades may be provided	40	40.0	40.0	90.0
Government to set up a special agency to cater for the needs of the beggars and it should chalk out plans for rehabilitation and feasible means of earning a livelihood	10	10.0	10.0	100.0
Total	100	100.0	100.0	

The table from above reveals that 20% of the respondents contacted on the ways the city authorities/central government and other developmental partners can stop street begging in Freetown indicated legislation to mitigate unemployment, improve

employability and self- reliance.30% indicated Government must make hard decisions in order to rid society of indiscipline and corruption, and outline measures to stop begging on our streets,40% indicated that More shelters for homeless should be

opened where training in various crafts and trades may be provided and 10% indicated that Government to set up a special agency to cater for the needs of the beggars and it should chalk out plans for rehabilitation and feasible means of earning a livelihood

## V. CONCLUSION

Begging is one of the phenomena of the metropolitan areas of Freetown and is kind of social problem which unlike other problems is seen in the public despite the fact that economic poverty is an important factor in the development of this phenomenon. The findings of this study show that there are four categories of street beggars in the streets of Freetown: beggars on the street, beggars of the streets, beggars in the streets, and beggars of street families. The study found that street beggars used various begging strategies, including disguising themselves to appear sick; pretending to be blind, deaf, or crippled; sending children into the street to beg; sitting in strategic places; moving into offices with medical referral letters; etc. Passersby seemed to be generous and sympathetic to beggars, although some people were harsh to beggars. The study found that the factors that cause people to become street beggars and the phenomenon of begging are diverse and multifaceted. Poverty influences begging to a large extent in all of the studied municipalities. Other factors included unemployment, physical challenges, death of parents, homelessness and family rejection

The findings of this study confirmed the theoretical foundations of the study in which in addition to the economic poverty, the culture of poverty also contributes effectively to the development and spread of begging. This is because the residence of more than half of the beggars is in slums periphery areas whose residents, according to the theory of culture of poverty, experience the culture of poverty more than other areas

The examination of peoples' attitudes toward begging and beggars indicated that in people's opinion helping beggars can have a positive effects on human's life therefore for some social groups such as people of rural social origin and people with low education and married people and those of low social classes, the beggars, and their community have a positive function for the society and they have favorable feeling towards them

These findings lead us to conclude that considering the positive attitudes of some strata of the society and some social groups towards begging and helping beggars and the positive functions of this phenomenon for people, introducing beggars to the society in terms of their physical status and their potentials and the extent of their need for help as well as organising and directing peoples' donations towards institutions and organizations which are responsible to cover those by injured society will be effective.

### 5.1. Recommendations

To address the problem of street beggars and begging activities in Freetown, the researcher is hereby making the following recommendations:

1. Policy planners must adopt multi-faceted, multi-targeted, and multi-tiered approaches if they are to have any impact on the lives of street beggars in all four categories. Specific policies and other legislative

frameworks are needed in terms of age, sex, disability, and family-related issues to effectively address the begging problem. In this regard, both preventative and responsive interventions are needed instead of rehabilitative solutions for each category of street beggars.

2. More efforts should be placed on changing community attitudes towards beggars who are children with disabilities and emphasizing the necessity of educating children with disabilities in order to enable them to face their future as independent individuals.
3. In as much as begging activities are not good at all, governments and other stakeholders should create opportunities for street beggars to make a living by other means
4. Legislation to mitigate unemployment, improve employability and self-reliance.
5. Government must make hard decisions in order to rid society of indiscipline and corruption, and outline measures to stop begging on our streets
6. More shelters for homeless should be opened where training in various crafts and trades may be provided
7. Government to set up a special agency to cater for the needs of the beggars and it should chalk out plans for rehabilitation and feasible means of earning a livelihood
8. Considering the fact that different beggars are in different physical status, therefore they should be categorized into different groups of able-bodies, physically and mentally disabled and addicts. This identification and categorization prepares the ground for a different planning in order to organize the beggars and solve their problem
9. Considering the fact that some parts of the city such as bus terminals, parks, graveyard and recreation centers are crisis-producing areas of the city in terms of begging, to identify the communication networks of beggars in these areas and to install advertising placards on different occasions with the intention of making people aware and providing guidance with the intention to offer work to beggars who are able to work it is.
10. It seems that to solve the problems of beggars, the help and participation of different organizations such as the city council and municipality, governorship, and social welfare organization is necessary. Police and charities are needed and expert division of labor is also necessary to consider the potentials of each of this organisation and to supervise their performance.
11. Organising nongovernmental associations of the retired and elderly people, forming teams to identify the poor by the members of these associations and directing people's donations towards the real poor can be effective in reducing the phenomenon of begging.

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# Developing a Conceptual model: Individual and Organizational Barrier on Glass Ceiling Effect (Sri Lankan Apparel Industry)

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**Abstract-**This research paper set out proposing a conceptual model for empirical examination in order to investigate individual and organizational barrier which leads to glass ceiling effect. Researcher has explored specific variables associated with glass ceiling effect. By reviewing the existing literature two gaps were identified. The first gap which is about how individuals been them self as a barrier to create a glass ceiling effect and the second gap is how organization been a barrier to create a glass ceiling effect. However it is noted that glass ceiling effect and its contextual validity has not yet been explored in Sri Lanka, especially in apparel industry. So it seems that this study makes a great contribution to the existing body of knowledge with proposed conceptual frame work. So this study creates a great platform for forthcoming research on glass ceiling effect.

**Index Terms-**Female Executives, Glass Ceiling Effect, Individual Barrier, Organizational Barrier

## I. INTRODUCTION

Understanding the essence of glass ceiling effect is a major concern of both the business and academic spheres today. There is an increasing trend that women are entering to the labour market (Jackson & O'Callaghan 2009). But the problem is majority of top management positions in almost all countries are generally held by men and women are hold lower management positions by having less authority (Jackson & O'Callaghan 2009). When comes to the Sri Lankan apparel industry, it has been feminized with 90 percent of young women employees (Jayawardena & Senevirathne 2003). But the problem is, in all most all organizational top positions are hold by men and they are having more authority than their female peer workers (Jayawardena & Senevirathne 2003). So the concept of "glass ceiling" has been used to explain why women fail to climb to the upper range of the corporate ladder regardless of their qualifications or achievement (Appelbaum et al 2013). This is arising due to the barriers which they face once they try to climb their corporate ladder (Yokongdi & Benson 2011). Simply the glass ceiling can be defined as, set of barriers to career advancement for women (Jackson & O'Callaghan 2009). According to the Smith, Caputi and Crittenden (2012) glass ceiling describe as the obstacles that lead to the underrepresentation of women in leadership and upper level management positions in an organization. As stated by the Chernesky (2003) glass ceiling is a set of barriers and it is transparent, even it is transparent it is very strong. And also Holly (1998) explains that they can see through it but they can't break it without inflecting considerable damage. It seems that it is very important to identify the barriers which lead to the glass ceiling effect in order to minimize it or preventing on it.

## II. LITERATURE REVIEW

This section mainly provides a brief explanation to the literature related to the glass ceiling effect and its relationship with individual and organizational barrier.

### A. Glass Ceiling Effect

In recent years, women as well as gender issues have turn into a major area of concern (Gu 2015). Further Kiaye and Singh (2013) stated that the involvement of women in the world in general has been on the increase over the past several decades and it is continuously improve. Whilst female representation at lower and middle management is on the increase trend but this situation was not seen in top or senior management positions (Dimovski, Skerlavaj & Kimman 2010).

So the under representation of the female employees in senior or top management positions in organization describe as the term of glass ceiling (Hwang 2007). According to the Afza and Newaz (2008) the term "ceiling" explains the limitations or barriers that blocking the upward advancement and the term "glass" used to describe the transparency of a ceiling and it indicate, that the

limitations is not immediately apparent and it is normally unwritten and un official. Some of the definitions of glass ceiling effect are summarized in following table.

Table 1: Definitions of Glass Ceiling Effect

Definition	Source
Obstacles that lead to the underrepresentation of women in leadership and upper level management positions in an organization.	Smith, Caputi and Crittenden (2012)
Set of barriers and it is transparent, even it is transparent it is very strong because of that women should do a considerable damage to break it.	Chernesky (2003)
Set of barriers to career advancement for women	Jackson & O'Callaghan (2009, p.460).
An invisible barriers and it prevent women from moving senior positions as well as moving in to the executive levels of corporation worldwide.	Madichie (2009)
Preventing qualified female individuals from advancing upward in their organization in to the management level position'	Wrigely (2002 p.28).
A barrier that prevent women from ascending to senior management position in large corporation	Bombuwela& De Alwis (2013, p.6).

According to the Virakul (2010) women try to reach the top of their position but they does not have the clear understand about hidden power and complexities of human interaction between males and females in the work place because of that they may not able to break the glass ceiling. So, women managers continually received lower organizational rewards such as, pay, promotions, desirable work assignment and training opportunities (Chernesky 2003). Furthermore, Afza and Newaz (2008) stated management perception, work environment, work life conflicts, sexual harassment and organizational policy as dimensions which come under the glass ceiling effect.

By considering the environment of Sri Lanka this study develops the conceptual model based on the five main elements as follows:

Table 2: Dimensions of Glass Ceiling Effect

Dimensions	Description
Management Perception	The extent to which that the management perceives that the female suitable holding leadership positions in the organization (Afza&Newaz 2008).
Work Environment	Surrounding that the employees are operate in (Afza&Newaz 2008).
Work Life Conflict	Push and pull between work responsibilities and family responsibilities (Nadeem & Abbas 2009, p.63).
Sexual Harassment	An unwelcome sexual advance, request for sexual favour and other verbal or physical conduct of a sexual nature that tends to create offensive work environment (Afza&Newaz 2008).
Organizational Policy	Formal document describing the organization's position on a particular aspect of compliance with regulations, standards, and guidelines (Afza&Newaz 2008).

### B. Barriers of Glass Ceiling Effect

There are several kinds of barriers that block women from rising to the most senior positions in the corporate world (Madichie 2009). 'barriers can be defined as a factor, events or phenomenon that prevent of controls access to individuals from making progress and barriers may be tangible or intangible, actual or perceived by the recipient' (Ismail & Ibrahim 2008, p.54).Some of the definitions of barriers that lead to the glass ceiling effect summarized in following table.

Table 3: Definitions of Barriers

Barrier	Definition	Source
Individual Barrier	The extent to which individual factors which are coming from themselves which influence their career advancement	Bombuwela& De Alwis(2013, p. 9).

	Lack on basic traits, skills and attitudes to succeed in leadership positions.	Singh & Terjesen (2008)
Organizational Barrier	The extent to which the employees see the organization as being responsible for lack performance of employee or the extent to which organizational barriers that coming from organizational structure and practices influence the employee development.  Corporate culture, corporate practices and corporate climate as organizational barrier.  Organizational culture, organizational and human resource practices, organizational networks and interpersonal relations, mentoring and role modeling and tokenism and minority presence.	Bombuwela & De Alwis (2013, p. 9).  Dimovski, Skerlavaj and Kimman (2010)  Tlaiss and Kauser (2010)

*C. Relationship between Glass Ceiling Effect and Barriers*

As stated by Jayawardane & Sajeewani (2017) education, experience can be taken as factors of individual barrier. But there is an increasing trend that the large numbers of women are graduating from educational institutes and they are gathering required experience as their male counterparts (Jayawardane & Sajeewani 2017). According to the Myers (2010) there is an increasing participation from the women in higher education and it is almost similar or greater than males but there is in disparity in the attainment of leadership positions. And also if women are lack on basic traits, skills and attitudes to succeed in leadership positions then they lacked on ambition and confidence which are critical qualities for hold the leadership positions in an organization (Singh & Terjesen 2008). As stated by the Smith, Crittenden and Caputi (2012) women behavior are nurturant, helpful, kind and sympathetic while men are assertive, ambitious, independent, forceful and self-confident which are highly important to hold the leadership positions.

As stated by the Bombuwela and De Alwis (2013) individual barrier is the most influential factors for women advancement. The findings indicate that male counterparts were overtly engaging in networking activities than the female counter partners, because of that men become even more visible than their female counterparts, while achieving top positions in the organization (Kiaye & Singh 2013). Furthermore Edirisinghe and Thalgaspitiya (2016) explain that there is moderately strong positive correlation between individual barrier and glass ceiling effect. Worrall et al (2010) outlined that lower self-esteem and confidence negatively affected for women career advancement. Cross (2010) in his research findings stated that thirteen of the thirty interviewees indicate that they want to achieve the senior management in the short term but individual barriers block their career advancement.

Women career progression is hammered by the organizational structure and practices (Tlaiss & Kauser 2010). Tlaiss and Kauser (2010) furthermore explains organizational culture, organizational and human resource practices, organizational networks and interpersonal relations, mentoring and role modeling and tokenism and minority presence identified as a factors of organizational barrier. Furthermore inadequate recruitment practices, lack of opportunity to participate in professional development, occupying staff versus line positions, a lack of understanding of, and commitment to, equal employment opportunity principles, the culture of an organization (Myers, 2010), standards in performance evaluation (Johns, 2013), transparency in promotion procedure and culture of long working hours (Cross 2010) are also comes under the indicators of organizational barrier.

According to the research findings total of 72 percent of the female employees noted organizational barrier such as the organization being very male-oriented, not concern about women's needs (Ismail & Ibrahim 2008). In terms of supervisor support in organizational set up, 56 percent of the women responded that they are treated fairly, that they have learned skills from their supervisors and their supervisors would help in their advancement (Ismail & Ibrahim 2008). But according to another research finding, majority of the respondents performances are not fairly evaluated by their superiors (Kiaye & Singh 2013). When comes to the organization culture almost 50 percent women are agreed culture is a barrier for them when they are try to reach the top of their corporate ladder (Clevenger & Singh 2013). Furthermore Edirisinghe and Thalgaspitiya (2016) explain that organizational barrier is the second most influential barrier on glass ceiling effect.

III. METHODOLOGY

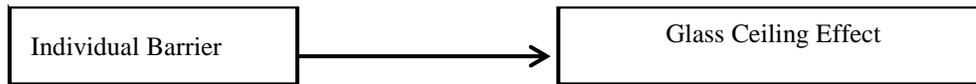
There are several databases and search engines, such as Emerald, Google Scholar, utilized in the study. This study contains a development of a conceptual model for empirical exploration of a phenomenon. Hence it analyses the prevailing literature for the organization of concepts and connections related to the phenomenon. Around 75 abstracts of articles were check to identify their applicability to the phenomena and 50 articles were finally selected and reviewed for identification of the concept and their relationship.

IV. RESULTS

The two gaps were identified after reviewing of the existing literature and it presented as follows:

**Gap one:** Impact of individual barrier on glass ceiling effect, has been carried out in different organizational settings under different methodology with different cultural setting. And there is only one research findings which conducted by covering Sri Lankan apparel industry but it is limited to large apparel industry. And also there are few western studies which investigate its relationship separately (refer figure 1). So according to the available literature it seems that there is a wide gap between theoretical as well as the empirical explanations of the previous studies and it is notable that the findings of this study may help to fill this gap to a considerable extent.

Figure 1: Gap one



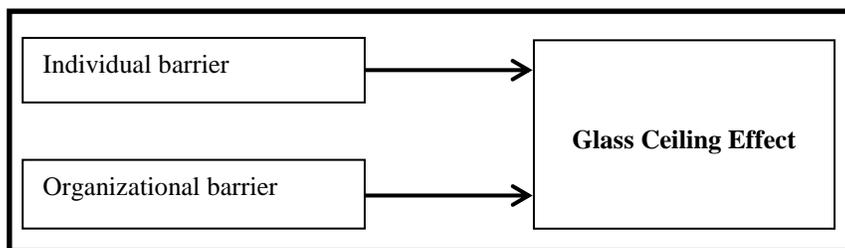
**Gap two:** A few western studies investigate the glass ceiling effect but not finalized how organization been a barrier to create a glass ceiling effect (refer figure 1). Moreover, as there is only one research finding which conducted by focusing Sri Lankan large apparel industry but it also not covers the entire industry. So it seems that there is a knowledge gap that could be attempted to address. As a result, this study pays more attention on the aspect of investigate the impact of organizational barrier on glass ceiling effect.

Figure 2: Gap two



#### A. Conceptual Model

The proposed conceptual model (refer figure 7) was developed based on variables and relationship identified through the literature review.



#### V. CONCLUSIONS AND IMPLICATIONS

This paper mainly focuses to develop a conceptual model to investigate the impact individual barrier and organizational barrier on glass ceiling effect among female executive employees in Sri Lanka apparel industry.

Even though the proposed model is yet to be tested empirically, it provide the great contribution to the contemporary issues in human resource management literature as this paper addresses the knowledge gap of barriers on glass ceiling effect. Therefore, the proposed model of this paper will set a new direction for future research to understand whether there is an impact of individual barrier and organizational barrier on glass ceiling effect.

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# Modelling and Simulation of Single-Phase Transfer-Field Reluctance Motor, Using Symmetrical Component Technique

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**ABSTRACT:** This work presents the mathematical modelling and steady state simulation study of single phase transfer field reluctance motor, operating in the asynchronous mode, using symmetrical components of unbalanced voltages of a 3 phase system approach. In electrical Engineering and other allied disciplines, the method of symmetrical components simplifies analysis of unbalanced 3 phase Power System both normal and abnormal conditions. The analysis of unsymmetrical fault conditions, using the method of symmetrical components, is a well known means of resolving an unbalanced three-phase system of impedances into three equivalent single-phase systems with independent impedance parameters. The above illustration simply reveals that any unbalanced three-phase system of voltages or currents can be seen as due to the super-position of two symmetrical three phase systems, having opposite phase sequence and a zero phase sequence, being equal to ordinary single-phase voltage or current system. In static machines like the transformer, the sequence impedance offered by the system are the same for positive and negative sequence currents. In case of rotating machines, like the transfer-field reluctance motor, the positive and negative sequence impedance are different (Electrical4u.com). From the fore-going, a synthesized equivalent circuit for a single-phase transfer field reluctance motor is obtained when it is considered as a three-phase transfer field reluctance motor with one of its stator windings disconnected. Empirical values were assigned to the equivalent circuit parameters. Matlab plots for the Torque/slip and Efficiency/Slip relationships for the newly existing single-phase transfer field reluctance motor with slip range  $0.5 \leq s \leq 1.5$  were obtained. The curves obtained were compared with those of the normal old-aged existing single phase induction motor counter-part with slip range  $0 \leq s \leq 2.0$ . The curves confirmed great similarities in their performance characteristics.

**KEY WORDS:** Asynchronous Machine, Symmetrical components, Unbalanced 3- phase systems, Normal induction machine, Transfer field reluctance machine, Clockwise rotating magnetic field, Anticlockwise rotating magnetic field, Slip, Torque.

## 1 – Introduction

The development of symmetrical component analysis depends upon the fact that in balanced system of impedances, sequence currents can give rise only to voltage drops of the same sequence. Once the sequence networks are available, these can be converted to single equivalent impedance.

The theory and application of normal induction machine dates over several decades ago. Conversely, the theory and application of transfer field reluctance machine is new in the field of electrical machine.

In its broad definition, a reluctance machine is an electric machine in which torque is produced by the tendency of a movable part to move into a position where the inductance of an energized phase winding is maximum. Structurally, the transfer field machine is basically a reluctance machine. It differs from the simple reluctance machine in two important respects namely;

- a) it has two sets of windings instead of one winding
- b) each winding has a synchronous reactance which is independent of rotor position whereas the winding reactance of a simple reluctance machine varies cyclically (Agu L.A. 1984).

The primitive poly-phase transfer field (TF) machine was first presented as a flux bridge machine with a two air-gap three element construction (Agu L.A. 1978). Following a careful study of the equations describing the air-gap flux density distribution, it was found that a topology manipulation yields an equivalent single air-gap two-element machine of much simpler mechanical construction. The equivalent circuit of the poly-phase TF machine operating in the asynchronous mode has been reported. Thus far, studies on the TF machine have been majorly limited to the poly-phase TF machine, and to the best of our knowledge, very few researchers have considered the single phase operation of the TF machine. The single phase transfer field (SPTF) machine is expected to have wider applications than the poly-phase version, because most

residential houses, offices and rural areas are supplied with single phase ac rather than 3-phase as power requirements of individual load items are rather small. Furthermore, single phase ac machines are invariably used in home appliances such as fans, refrigerators, vacuum clearers, washing machines, portable tools etc.

This work re-examines some aspects of the poly-phase TF machines operating in the asynchronous mode and develops the steady state equivalent circuit of the SPTF machine operating in the asynchronous mode, from which the steady state performance characteristics can be predicted. The single phase equivalent circuit of the TF machine operating in the asynchronous mode is derived in a manner which is consistent with the derivation of a single-phase induction motor by disconnecting one of its supply lines and using the concept of symmetrical component (Obute et al 2016)

## 2 ó Physical arrangement of the single-phase Transfer field reluctance machine.

The single phase transfer field reluctance (SPTF) machines are basically single-phase induction motors built with variable air-gap reluctance and with no d.c. supply on the rotor. The machine in its most primitive form comprises two identical salient-pole machines (A&B) whose rotors are mechanically coupled together but with their pole axes displaced by  $0.5\pi$  electrical radians in space. Each unit machine comprising the TF machine has two sets of windings known as the main and auxiliary windings respectively. The two windings are electrically isolated but mechanically coupled and occupy the same stator slots for maximum coupling. The two windings are integrally wound for the same number of poles as the rotor poles. The main windings of the respective halves are connected in series and energized from the utility supply, while the auxiliary windings are connected in series opposition between the two halves of the machine as shown in fig 1b. The machine is brushless and there are no windings on the rotor; the main and auxiliary windings being located on the stator side only. The machine is not self starting and

has a torque-slip curve similar to that of a single phase induction machine except that its synchronous speed is  $0.5\omega_0$  instead of  $\omega_0$  as obtainable in induction machines. Analogously to an induction machine the relationship between the frequency of the current in the main and auxiliary windings is;  $\omega_0: [(\omega_0 - 2\omega_r) = (2s + 1)\omega_0]$  (Agu L.A. et al 2002). In this novel configuration, the auxiliary windings mimic the role of the rotor windings in an induction machine. The roles of the main and auxiliary windings can be interchanged and will produce the same result.

b.  $\delta$  The connection diagram of single phase TF machine

### 3 $\delta$ Single-Phase Transfer Field Reluctance Machine Concept

Obviously, if one line of a three-phase transfer-field reluctance machine is opened by the way of disconnection, while the motor is running with moderate load, the machine maintains running although at a slower speed. This condition is single-phase operation and it gives the implication that the three-phase transfer-field motor has eventually become a single-phase counterpart.

The single  $\delta$  phase transfer field motor is analogous to three-phase transfer field motor counterpart in which a single-phase winding replaces the three-phase windings. A single-phase current in a single-phase winding produces a pulsating, not a rotating magnetic field. Since there is only one phase on the stator winding, the magnetic fields in all single-phase asynchronous machines do not rotate. Instead it pulses, getting first larger and then smaller, but always remaining in the same direction. Because there is no rotating stator magnetic field, all single-phase asynchronous motors have no starting torque.

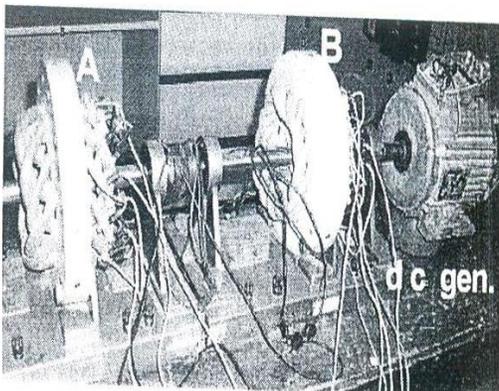
However, once the rotor begins to turn, an induced torque will be produced in it. This stationary pulsating magnetic field of single phase motor can be resolved into two rotating magnetic fields, each of equal magnitude but rotating in opposite directions. The machine responds to each magnetic field separately, and the net torque in the machine will be the cumulative sum of the torque due to each of the two magnetic fields (Stephen J.C. 2005)

The flux density ( $B_s$ ) of the stationary magnetic field is given by;

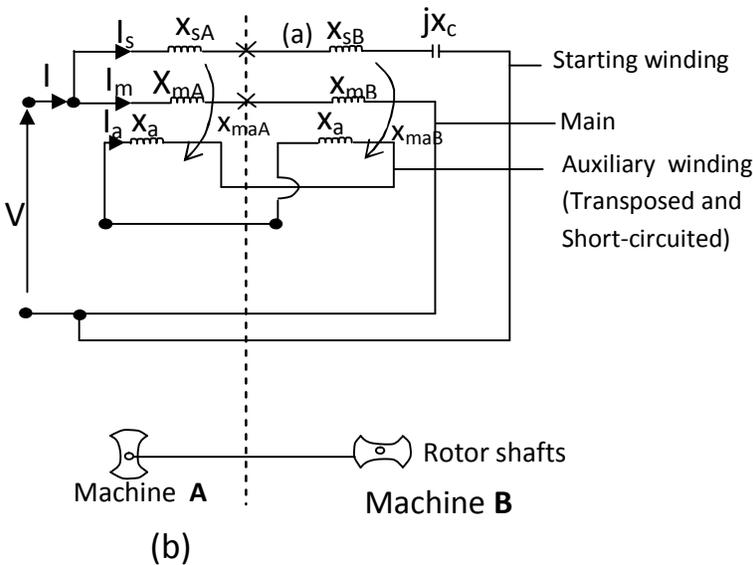
$$B_{s(t)} = B_{max} \cos \omega t \quad \text{--- (1)}$$

Equation 1 has two components.

The first component represents the resolving field moving in the positive direction, while the second



(a)



(b)

Fig 1, a  $\delta$  The pictorial diagram of single phase transfer field (TF) machine

component represents the revolving field moving in the negative direction, all having amplitude equal to  $B_{max}$ .

The fields in the positive and negative direction are known as clockwise and counter-clockwise rotating magnetic fields. The two fields rotate at synchronous speed  $\omega_s$ .

A clockwise-rotating magnetic field ( $B_{cw}$ ) can be expressed as;

$$B_{cw}(t) = (0.5 B_{max} \cos \omega t) \hat{i} + (0.5 B_{max} \sin \omega t) \hat{j} \quad \text{--- 2}$$

Similarly, a counter clockwise-rotating magnetic field ( $B_{ccw}$ ) can be expressed as;

$$(B_{ccw})(t) = (0.5 B_{mas} \cos \omega t) \hat{i} + (0.5 B_{max} \sin \omega t) \hat{j} \quad \text{--- 3}$$

Hence, equation 3.1 becomes;

$$B_s(t) = B_{cw}(t) + B_{ccw}(t) \quad \text{--- 4}$$

The resulting instantaneous torque developed due to the revolving fields has four components, viz;

- (i) A torque due to the interaction of the clockwise travelling stator winding and auxiliary windings magneto-motive force (mmf) distributions.
- (ii) A torque due to the interaction of the counter-clockwise travelling stator and rotor winding mmf distribution.
- (iii) A torque due to clockwise travelling stator winding mmf distribution and the counter-clockwise travelling rotor winding mmf distribution
- (iv) A torque due to counter-clockwise travelling stator winding mmf distribution and the clockwise travelling rotor winding mmf distribution.

The first component gives steady non-pulsating torque acting on the rotor in the clockwise direction and gives rise to a component torque/slip characteristic of the form obtainable from a poly-

phase TF motor. The second component gives rise to a similar torque/slip character; stic, the torque acting in the opposite, counter-clockwise direction. The third and fourth components give rise to torque which pulsate at twice supply frequency and do not contribute to the mean torque of the motor. This oppositely travelling mmf distribution do not contribute the mean torque.

For the single phase transfer field reluctance motor, the reaction between the fields created by the current in the main winding, causes the rotation of the rotor. The difference between the rotor speed ( $\omega_r$ ) and the synchronous speed ( $\omega$ ) is the slip (s), usually given as the percentage of the synchronous speed.

The size of mechanical load on the motor varies directly as slip(s) and inversely as the rotor speed ( $\omega_r$ ). So far, as stated before, the characteristics features of single phase reluctance motor is similar to that of a normal induction motor counterpart, but with synchronous speed being half of the normal induction motor.

If we let us suppose that;

$\omega_R$  = synchronous speed of the transfer field Motor, then from the fore going expression;

$$\omega_R = 0.5\omega \quad \text{--- 5}$$

Generally, for normal induction machine, the relationship between s,  $\omega_r$  and  $\omega$  is given by;

$$\omega_r = \omega (1-s) \quad \text{---6}$$

Similarly, for the half speed machine of our interest, the slip ( $s_{cw}$ ) with respect to clockwise rotating field is given by;

$$s_{cw} = \frac{\omega - \omega_r}{\omega} \quad \text{--- 7}$$

If we substitute equation 5 into equation 7, we obtain;

$$s_{cw} = \frac{\omega - 0.5\omega}{\omega} \quad \text{--- 8}$$

Like-wise, the rotor direction of rotation is in opposition to that of the counter clock-wise rotating field, therefore, the slip ( $s_{ccw}$ ) with respect to the counter clockwise rotating field is;

$$s_{ccw} = \frac{V_{YB}}{V_{YB}} = \frac{(V_{YB})}{V_{YB}} \quad \text{--- (9)}$$

By substituting equation 5 into equation 9, we have;

$$s_{ccw} = \frac{V_{YB}}{V_{YB}} \quad \text{--- (10)}$$

If equation 6 is put into equations 8 and 10, we have;

$$s_{ccw} = \frac{V_{YB}}{V_{YB}} = 2s \quad \text{--- (11)}$$

Similarly

$$s_{ccw} = \frac{V_{YB}}{V_{YB}} = 3-2s \quad \text{--- (12)}$$

### 3.3 Equivalent Circuit of Single-Phase Transfer Field reluctance Machine

This forms the nucleus of this work. The equivalent circuit of the motor is derived, using symmetrical components of unbalanced three-phase systems approach.

The derivation is obtained on the assumption that the motor is a three-phase type with one of its stator windings disconnected as illustrated in fig 2 below

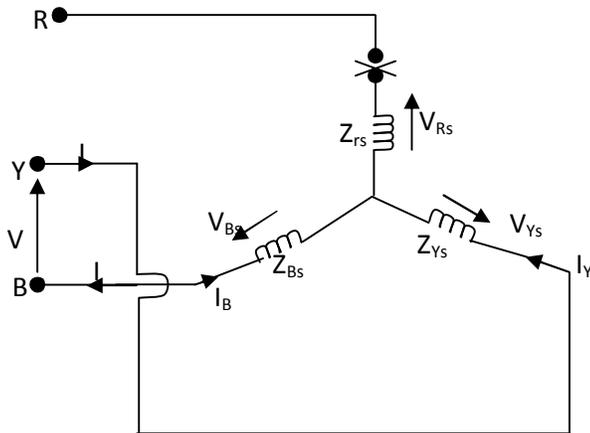


Fig 2 The single phase operation of a three phase system of supply with disconnected red phase.

From fig 2, it can be observed that;

$$\left. \begin{aligned} I_R &= 0 \\ I_Y &= I \\ I_B &= -I_Y = -I \end{aligned} \right\} \quad \text{--- (13)}$$

$$\left. \begin{aligned} V &= V_{YS} + (-V_{BS}) = V_{YS} - V_{BS} \\ V_{YS} &= -V_{BS} = \frac{V}{\sqrt{3}} \\ V_{RS} &= 0 \\ Z_{YS} &= Z_{BS} \end{aligned} \right\} \quad \text{--- (14)}$$

Where  $I$  = Input current,  $I_R$  Current at the Red phase,  $I_Y$  Current at the yellow phase,  $I_B$  = Current at the blue phase,  $V_{RS}$ ,  $V_{YS}$ ,  $V_{BS}$  are voltage drops across the Red phase, yellow phase and Blue phase of the stator windings respectively.

In conformity with C.L. Fortesque theorem, the symmetrical component of fig 2 can be resolved as the sum of fig 3.3 (a,b,c) below.

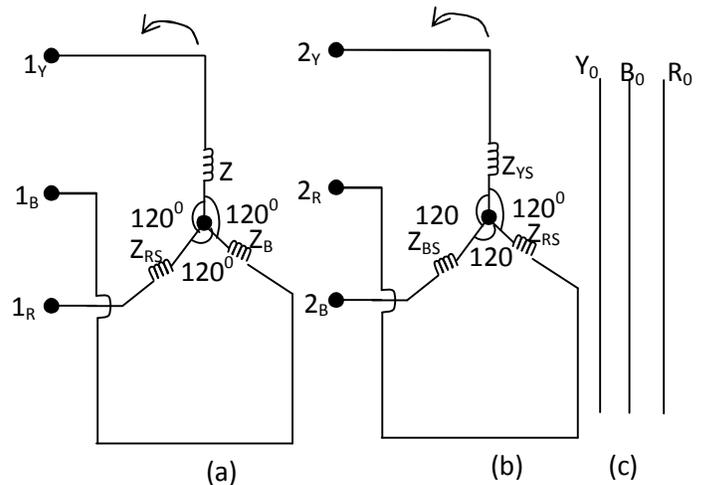


Fig 3- (a) = Positive sequence phasor  
 (b) = Negative sequence phasor  
 (c) = Zero sequence phasor (J.B. Gupta 2008)

For the positive (+) sequence phasor, taking the Yellow (Y) phasor as reference phasor as in fig 3a, we obtain that;

$$\left. \begin{aligned} I_{1Y} &= I_{1Y} e^{j0} = I_{1Y} \text{ (Reference phasor)} \\ I_{1B} &= I_{1Y} \angle -120^\circ = a^2 I_{1Y} \\ I_{1R} &= I_{1Y} \angle 120^\circ = a I_{1Y} \end{aligned} \right\} \quad \text{í 15}$$

Similarly, for the negative (-) sequence quantities as in fig 3b;

$$\left. \begin{aligned} I_{2Y} e^{j0} &= I_{2Y} (1+j0) \text{ (Reference phasor)} \\ I_{2B} &= I_{2Y} \angle 120^\circ = a I_{2Y} \\ I_{2R} &= I_{2Y} \angle -120^\circ = a^2 I_{2Y} \end{aligned} \right\} \quad \text{í 16}$$

Also, for the Zero (0) phase sequence of fig 3c.

$$Y_0 = B_0 = R_0 \quad \text{í 17}$$

Where a = phase sequence operator

For the unbalanced system of current of fig 2,

$$\left. \begin{aligned} I_Y &= I_{1Y} + I_{2Y} + I_{0Y} \\ I_B &= a^2 I_{1Y} + a I_{2Y} + I_{0Y} \\ I_R &= a I_{1Y} + a^2 I_{2Y} + I_{0Y} \end{aligned} \right\} \quad \dots 18$$

The compact form of equation 18 can be put in matrix form as below:

$$\begin{bmatrix} I_Y \\ I_B \\ I_R \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ a^2 & a & 1 \\ a & a^2 & 1 \end{bmatrix} \begin{bmatrix} I_{1Y} \\ I_{2Y} \\ I_{0Y} \end{bmatrix} \quad \text{í 19}$$

The inverse form of equation 19 is given as;

$$\begin{bmatrix} I_{1Y} \\ I_{2Y} \\ I_{0Y} \end{bmatrix} = \frac{1}{3} \begin{bmatrix} 1 & 1 & 1 \\ a & a^2 & 1 \\ 1 & a & a^2 \end{bmatrix} \begin{bmatrix} I_Y \\ I_B \\ I_R \end{bmatrix} \quad \text{í 20}$$

N.B: Equations (17-20) hold for voltage also.

In phase sequence representation;

$$V_{YS} = V_{Y+} + V_{R-} + V_{R0} \quad \text{í 21}$$

Similarly;

$$V_{BS} = V_{B+} + V_{B-} + V_{B0}$$

But from equation 20 equation 21 yields;

$$V_{Y+} = V_{1Y} = \frac{1}{3} (V_{YS} + aV_{BS} + a^2 V_{RS}) \quad \text{í 23}$$

Similarly;

$$V_{Y-} = V_{2Y} = \frac{1}{3} (V_{YS} + a^2V_{BS} + aV_{RS}) \quad \text{í 24}$$

As 1 the Red phase is disconnected,  $V_{RS} = 0V$

Hence, equations 3.23 and 34 yield;

$$\begin{aligned} V_{Y+} &= \frac{1}{3} (V_{YS} + aV_{BS}) \\ &= \frac{1}{3} (V_{YS} - aV_{YS}) \quad (\text{as } V_{YS} = -V_{BS}) \\ &= \frac{1}{3} V_{YS} \quad (1 \text{ ó } a) \end{aligned}$$

Similarly;

$$\begin{aligned} V_{Y-} &= \frac{1}{3} (V_{YS} + a^2V_{BS}) \\ &= \frac{1}{3} (V_{YS} - a^2V_{YS}) \\ &= \frac{1}{3} V_{YS} (1 - a^2) \end{aligned} \quad \text{í 26}$$

$$\text{Also, } V_{R0} = \frac{1}{3} (V_{YS} + V_{BS} + V_{RS})$$

$$= \frac{1}{3} (V_{YS} + V_{BS})$$

$$= \frac{1}{3} (V_{YS} - V_{YS})$$

$$= 0 \quad \text{í 27}$$

Substituting equations (25 ó 27) into equation

21, we have;

$$\begin{aligned} V_{YS} &= \frac{1}{3} \left[ \frac{1}{3} V_{YS} + \frac{1}{3} V_{YS} + 0 \right] \\ &= \frac{1}{3} \left[ \frac{2}{3} V_{YS} \right] (1-a) (a+2) \\ &= (a+2)V_{Y+} \end{aligned} \quad \text{í 28}$$

Similarly, from equation 22;

$V_{B+}$ ,  $V_{B-}$  and  $V_{B0}$  can be obtained as below

For + sequence phasor (taking blue phase as the reference phasor), we have;

$$\left. \begin{aligned} I_{1B} &= I_{1B} e^{j0} = I_{1B} \text{ (reference phasor)} \\ I_{1R} &= a^2 I_{1B} = I_{1B} \angle -120^\circ \\ I_{1Y} &= a I_{1B} = I_{1B} \angle 120^\circ \end{aligned} \right\} \quad \text{í 29}$$

For the - sequence quantity

$$\left. \begin{aligned} I_{2B} &= I_{2B} (1+j0) = I_{2B} \text{ (reference phasor)} \\ I_{2R} &= I_{2B} \angle 120^\circ = a I_{2B} \\ I_{2Y} &= I_{2B} \angle -120^\circ = a^2 I_{2B} \end{aligned} \right\} \quad \dots 30$$

As before;

$$\left. \begin{aligned} I_B &= I_{1B} + I_{2B} + I_{0B} \\ I_R &= I_{1R} + I_{2R} + I_{0R} = a^2 I_{1B} + a I_{2B} + I_{0B} \\ I_Y &= I_{1Y} + I_{2Y} + I_{0Y} = a I_{1B} + a^2 I_{2B} + I_{0B} \end{aligned} \right\} \quad \text{í 31}$$

Equation 31 in its compact form yields;

$$\begin{bmatrix} I_{00} \\ I_{10} \\ I_{20} \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ a^2 & a & 1 \\ a & a^2 & 1 \end{bmatrix} \begin{bmatrix} I_{00} \\ I_{10} \\ I_{20} \end{bmatrix} \quad \text{í 32}$$

Inverting the matrix of equation 32 yields;

$$\begin{bmatrix} I_{00} \\ I_{10} \\ I_{20} \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ a^2 & a & 1 \\ a & a^2 & 1 \end{bmatrix}^{-1} \begin{bmatrix} I_{00} \\ I_{10} \\ I_{20} \end{bmatrix} \quad \text{í 33}$$

Solving for  $V_{B+}$ ,  $V_{B-}$  and  $V_{B0}$  as in  $V_{Y+}$ ,  $V_{Y-}$  and  $V_{Y0}$  yields;

$$\begin{aligned} V_{B+} &= \frac{1}{3} (V_{BS} + aV_{RS} + a^2V_{YS}) \\ &= \frac{1}{3} (V_{BS} + a^2V_{YS}) \\ &= \frac{1}{3} (a^2V_{YS} + V_{RS}) \\ &= \frac{1}{3} V_{YS} (a^2 - 1) \end{aligned} \quad \text{í 34}$$

Similarly

$$\begin{aligned} V_{B-} &= \frac{1}{3} (V_{BS} + a^2V_{RS} + aV_{YS}) \\ &= \frac{1}{3} (aV_{YS} - V_{YS}) \\ &= \frac{1}{3} V_{YS} (a - 1) \end{aligned} \quad \text{í 35}$$

$$\begin{aligned} \therefore V_{BS} &= V_{B+} + V_{B-} + V_{B0} \\ &= -\frac{(a^2 - 1)}{(a^2 - 1)} V_{Y-} \end{aligned} \quad \text{í 36}$$

The equation for supply voltage  $V$  can be obtained by substituting equations 28 and 36 into equation 14 as below;

$$\begin{aligned} V &= V_{YS} - V_{BS} \\ &= (a+2)V_{Y+} - \frac{(a^2 - 1)}{(a^2 - 1)} V_{Y-} \\ &= (a+2)V_{Y+} + \frac{(a^2 - 1)}{(a^2 - 1)} V_{Y-} \end{aligned} \quad \text{í 37}$$

Taking similar step as in the symmetrical components analysis of voltages, the symmetrical components of the currents can be obtained as below;

$$I_{Y+} = \frac{1}{3} (I \text{ ó } aI)$$

$$= \frac{1}{3} I (1 \text{ ó } a) \quad \text{í 38}$$

Similarly;

$$\begin{aligned} I_{Y-} &= \frac{1}{3} (I \text{ ó } a^2I) \\ &= \frac{1}{3} (1 \text{ ó } a^2) I \\ I_{Y0} &= 0 \end{aligned} \quad \text{í 39, 40}$$

Transposing equations (38 ó 40) for  $I$  we have;

$$I+ = \frac{1}{3} \frac{I}{(1 \text{ ó } a)} \quad \text{í 41}$$

$$I- = \frac{1}{3} \frac{I}{(1 \text{ ó } a^2)} \quad \text{í 42}$$

The total input impedance of fig 2 is given by;

$$Z = \frac{1}{3} \quad \text{í 43}$$

Substituting equations 37, 41 and 42 into equation 43, yields;

$$\begin{aligned} Z &= \frac{1}{3} \frac{1}{(1 \text{ ó } a)} + \frac{1}{3} \frac{1}{(1 \text{ ó } a^2)} \\ &= Z+ + Z- \end{aligned} \quad \text{í 44}$$

Where

$Z+$  = Positive phase sequence impedances

$Z-$  = Negative phase sequence impedances

For a three-phase transfer field reluctance motor, the phase-sequence network with positive + and negative - sequence is shown in fig 4 (a/b) respectively as below.

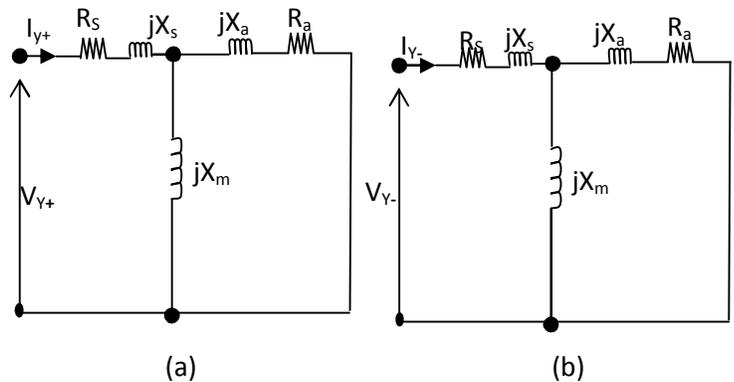


Fig 4 ó (a) Per phase + sequence of 3 – phase transfer field motor at stand-still ( $s = 1$ )

(b) Per phase – sequence of 3 – phase transfer field motor at stand-still ( $s = 1$ ).

Where,  $R_s$  = resistance of main (stator) winding

$X_s$  = Leakage reactance to main (stator) winding.

$X_m$  = Magnetizing reactance

$R_a$  = Stand-still auxiliary resistance to main winding

$X_a$  = Stand-still auxiliary winding leakage reactance to main winding

$I_{Y+}, I_{Y-}$  = Main winding currents

$V$  = Applied voltage

To realize the equivalent circuit of the single-phase transfer field reluctance motor, the positive (+) and negative (-) phase sequence networks of fig 4, must be interconnected in series, and on the condition that only  $V_{Y+}$  produces the voltage source as in fig 5 below.

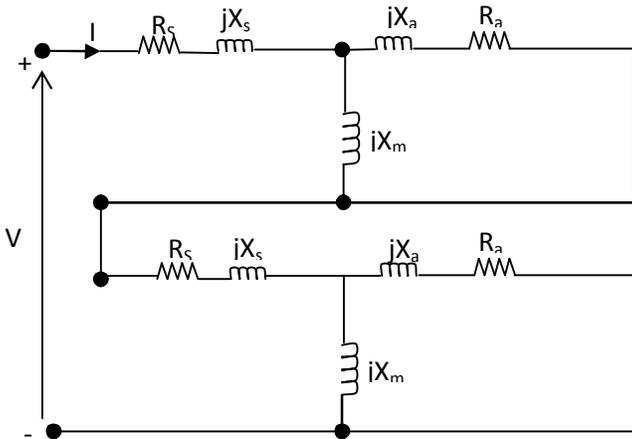


Fig5 ó Equivalent circuit of single ó phase transfer field reluctance motor at stand-still ( $s = 1$ )

Since the pulsating magnetic field is revolved into clockwise and counter clockwise fields, having equal and opposite fluxes with the motor (9), the magnitude of each rotating flux is one half of the alternating flux. Therefore, it is assumed that the two rotating fluxes are acting on the separate rotors. Hence, we then assume that the single-phase transfer field motor consists of two rotors having a common stator winding (as in induction motors) and two imaginary rotors as shown in fig 3.6 below. At stand-still, the impedance of each auxiliary winding referred to the stator (main) winding is  $0.5R_a + j0.5 X_a$ .

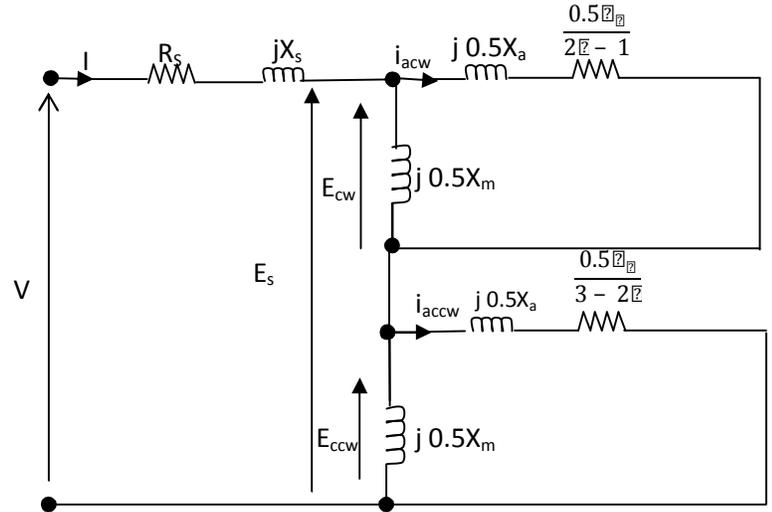


Fig 6 - Equivalent circuit of single phase transfer field reluctance motor rotating at slip  $s$ .

#### 4 – Performance Characteristics of Single Phase transfer-field reluctance motor

The performance characteristics of the motor can be determined from its equivalent circuit of fig 7 for a range values of slip  $0.5 \leq s \leq 1.5$ . The data of the experimental machine are given in table 1 below.

**Table 1** – Parameters for steady state analysis of single phase TF machine

S/N	Parameter	Value
1	$R_s$	1.20
2	$R_a$	1.20
3	$X_s$	1.90
4	$X_a$	1.90
5	$X_m$	33.82
6	$X_{st}$	7.54
7	$r_{st}$	2.5
8	$F$	50Hz
9	No of Poles	2
10	$V$	220v

From fig 7, the e.m.F induced in the main (stator) winding by the clock-wise and counter-clockwise fluxes are  $E_{cw}$  and  $E_{ccw}$  respectively.

Hence, the resultant induced e.m.f ( $E_s$ ) in the main winding is given by;

$$E_s = E_{cw} + E_{ccw} \tag{45}$$

Since the circuits of the auxiliary (rotors) windings due to the clockwise and counterclockwise fields are identical at stand -still, we can write that;

$$E_{cw} = E_{ccw} \tag{46}$$

From equations 45 and 46,

$$E_{cw} - E_{ccw} = 0.5E_s \tag{47}$$

The auxiliary winding impedance  $Z_{cw}$  due to clockwise rotating field is;

$$\begin{aligned} Z_{cw} &= R_{cw} + jX_{cw} \\ &= \frac{2.222}{2222} + \frac{0.522}{0.522} // \frac{0.522}{0.522} \\ &= \frac{\frac{2.222}{2222} \cdot \frac{0.522}{0.522} + \frac{0.522}{0.522}}{\frac{2.222}{2222} + \frac{0.522}{0.522}} \end{aligned} \tag{48}$$

Similarly, the auxiliary winding impedance  $Z_{ccw}$  due to counter clockwise rotating field is;

$$\begin{aligned} Z_{ccw} &= R_{ccw} + jX_{ccw} \\ &= \frac{2.222}{2222} + \frac{0.522}{0.522} // \frac{0.522}{0.522} \\ &= \frac{\frac{2.222}{2222} \cdot \frac{0.522}{0.522} + \frac{0.522}{0.522}}{\frac{2.222}{2222} + \frac{0.522}{0.522}} \end{aligned} \tag{49}$$

Hence equation 45 yields;

$$\begin{aligned} E_s &= I(Z_{cw} + Z_{ccw}) \\ V &= I(Z_s + Z_{cw} + Z_{ccw}) \\ \Rightarrow I &= \frac{V}{Z_s + Z_{cw} + Z_{ccw}} \end{aligned} \tag{50}$$

Where,  $Z_s = R_s + jX_s$

More-still, by current division principle;

$$i_{acw} = \frac{2.222}{2.222 + 0.522} I \tag{51}$$

Similarly;

$$i_{accw} = \frac{2.222}{2.222 + 0.522} I \tag{52}$$

## 6 – Power across air-gap, Output Power and Torque in single phase transfer field reluctance motor

Mechanical Power and torque can be computed by application of power and torque relations. The torques produced by the clock-wise ( $T_{cw}$ ) and counter clockwise ( $T_{ccw}$ ) fields each can be treated. The interactions of the oppositely rotating flux and mmf waves cause torques pulsation and twice stator frequency but produce no average torques.

Still from fig 7, the air-gap power delivered by the stator (main) winding of the machine to the clock-wise field ( $P_{gcw}$ ) and the counter clockwise field ( $P_{gccw}$ ) are given by;

$$P_{gcw} = \frac{2.222}{2222} (i_{acw})^2 \text{ Watts} \tag{53}$$

Similarly,

$$P_{gccw} = \frac{2.222}{2222} (i_{accw})^2 \text{ Watts} \tag{54}$$

More still mechanical Power output for clockwise field

$$\begin{aligned} (Pm_{cw}) &= [1 - (2s-1)] P_{gcw} = 2(1-s) P_{gcw} \\ &= \frac{2.222}{2222} \left( \frac{2.222}{2222} \right) \cdot \frac{2.222}{2222} \text{ Watts} \end{aligned} \tag{55}$$

Similarly, the mechanical power output for the counter clock-wise for rotating field  $Pm_{ccw} = [1 - (3-2s)] P_{gccw}$

$$\begin{aligned} &= -2(1-s) P_{gccw} \\ &= \frac{2.222}{2222} \left( \frac{2.222}{2222} \right) \cdot \frac{2.222}{2222} \text{ Watts} \end{aligned} \tag{56}$$

The mechanical net power output ( $Pm_n$ ) is the cumulative sum of equations 55 and 56

$$\begin{aligned} \Rightarrow Pm_n &= Pm_{cw} + Pm_{ccw} \\ &= \frac{2.222}{2222} (1 - 2) \left( \frac{2.222}{2222} \right)^2 - \frac{2.222}{2222} \left( \frac{2.222}{2222} \right)^2 \text{ Watts} \end{aligned} \tag{57}$$

The Electromagnetic torque ( $T_{cw}$  and  $T_{ccw}$ ) developed by the two rotating fields can be expressed as;

$$T_{cw} = \frac{2}{2} P_{gcw} \text{ Nóm} \tag{58}$$

Substituting equation 53 into 58 we have;

$$T_{cw} = \frac{2}{2} \cdot \frac{2.222}{2222} \cdot \frac{2.222}{2222} \text{ N-m} \tag{59}$$

$$\text{Similarly, } T_{ccw} = \frac{2}{2} P_{gccw} \text{ N-m} \tag{60}$$

Putting equation 54 into 60 yields;

$$T_{ccw} = - \frac{2}{2} \cdot \frac{2.222}{2222} \cdot \frac{2.222}{2222} \text{ N-m} \tag{61}$$

NB:  $\omega$  is the synchronous angular velocity in mechanical radians per second.

Minus sign attached to equation 61 is due to opposite direction of the field to the clockwise rotating field, hence, producing a negative torque.

Therefore, from the fore-going, since the torque of the counter clock wise field ( $T_{ccw}$ ) is in the opposite direction to that of the clockwise field ( $T_{cw}$ ), the net internal torque ( $T_{net}$ ) of the transfer field (TF) machine is given by;

$$T_{net} = T_{cw} + T_{ccw}$$

$$= \frac{1}{2} (Pg_{cw} + Pg_{ccw})$$

$$= \frac{1}{2} \left[ \frac{3}{2} \frac{V^2 R_r}{s Z_s^2} - \frac{3}{2} \frac{V^2 R_r}{(2-s) Z_s^2} \right] \text{ N-m} \quad \dots 62$$

$$\left. \begin{aligned} \omega &= 2\pi n_s \\ n_s &= \frac{120}{2} \text{ r.p.s} \end{aligned} \right\} \quad \dots 63$$

**7 – Torque – Slip characteristics of Single phase transfer field reluctance motor**

The slip/speed-torque characteristics of all asynchronous motor are quite importance in the selection of motor drives.

In addition, the ratio of maximum torque to rated torque, ratio of starting current to rated current, ratio of starting torque to rated torque, and the ratio of no-load current to rated current are equally significant.

The above characteristics can be conveniently determined by means of the equivalent circuit of such motor. (J.B. Gupta 2014).

**8 – Efficiency of Single Phase transfer field reluctance motor**

Obviously, it is the internal losses (both electrical and mechanical) of a machine that contribute majorly to reduction in its performance. Machine performance is characterized by its efficiency. Owing to the fact that the rotor currents produced by the two components air-gap fields are of different frequencies, the total

auxiliary winding  $I^2R_a$  loss is the numerical sum of the losses caused by each field.

Thus clockwise field rotor (auxiliary winding)  $I^2R_a$  loss equals  $(2s-1) pg_{cw}$ . Conversely, counter clockwise field rotor (auxiliary winding)  $I^2R_a$  loss equals  $(3-2s) pg_{ccw}$ .

These contribute immensely to the overall reduction in efficiency of the motor. More-still, the poor pull out and starting torque of single phase transfer field motor to an extent affect its performance and thereby makes it (for now) inferior to those of a comparable single phase induction motor counterpart. The overall effect of these losses is a reduction in the net mechanical power output of the motor and the corresponding efficiency

The motor efficiency ( $\eta$ ) is given by;

$$\eta = \frac{P_{mech}}{P_{in}} \times \frac{100}{1} \quad \dots 63$$

Where;

$$\text{Motor input power} = VI \cos \phi \quad \dots 64$$

$$\text{But the motor power factor } (\cos \phi) = \frac{R_s}{Z_s}$$

$$= \frac{R_s}{\sqrt{R_s^2 + X_s^2}} \quad \dots 65$$

Where,  $R_s$ ,  $R_{cw}$ , and  $R_{ccw}$  are the real parts of  $Z_s$ ,  $Z_{cw}$  and  $Z_{ccw}$  respectively

∴ Putting equations 50, 57, 64 and 65 into equation 63 we have;

$$\eta = \frac{P_{mech}}{P_{in}} \times 100 \quad \dots 66$$

Motor losses are assumed negligible.

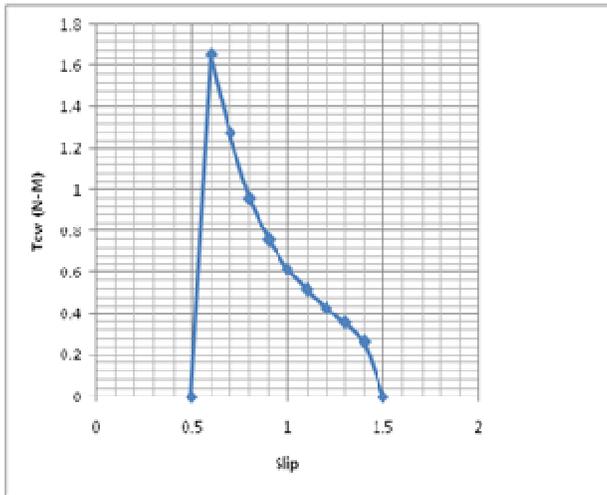
**9 – Simulation And Results**

In this work, simulation is carried out with the models developed.

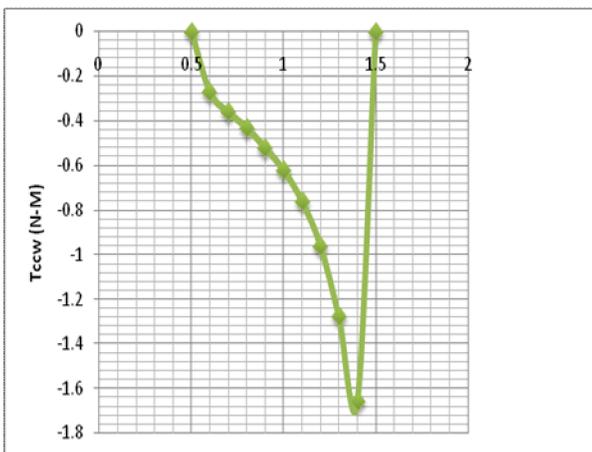
If the machine parameters of table 1 are effectively used, equations 59, 61 and 62 become essential tool for the steady state simulation plots, characterizing the machine performance indices.

The matlab plots for the clockwise torque  $T_{cw}$ , counter clockwise torque  $T_{ccw}$ , net torque  $T_{net}$  and the superimposition of  $T_{cw}$ ,  $T_{ccw}$  and  $T_{net}$  against varying values of slip  $s$ , ranging from  $0.5 \leq s \leq 1.5$  are shown in fig 7 a,b,c, and d respectively.

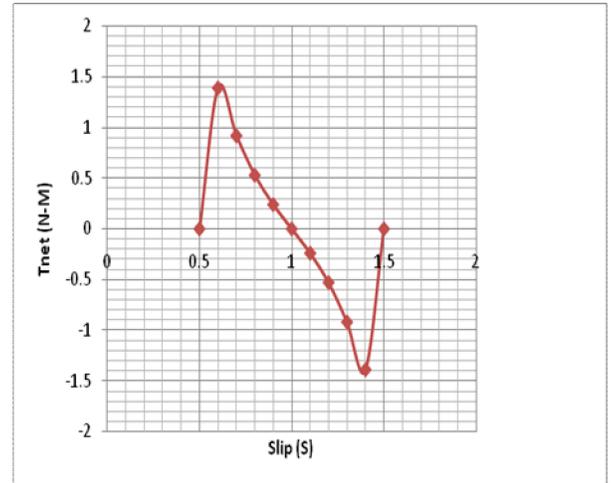
More still, by careful use of the machine parameters and equations 50 to 66 with varying values of slip  $s$ , a matlab plot for the machines efficiency against slip(s) during operation is obtained as shown in fig 8.



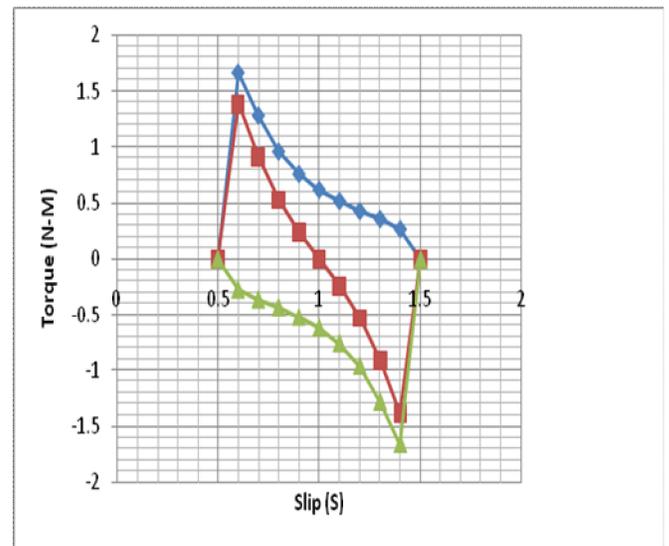
(a)



(b)

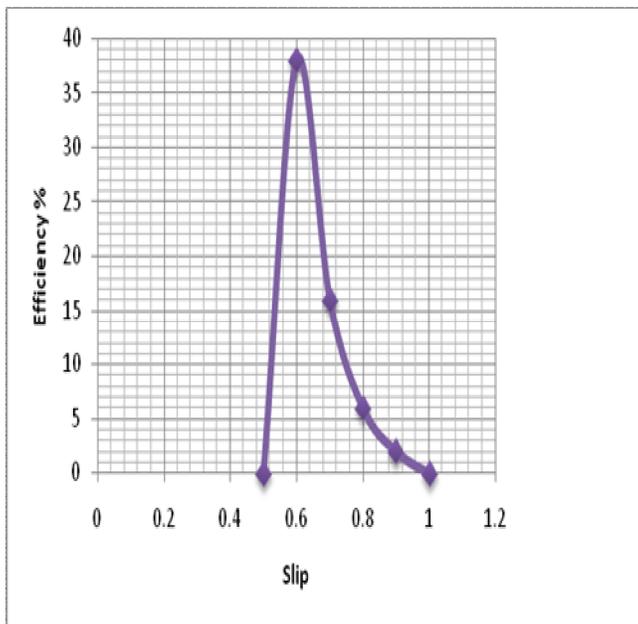


(c)



(d)

**Fig 7 (a)** – Plot for the clockwise torque ( $T_{cw}$ ) against slip ( $s$ )  
**(b)** – Plot for the counter clockwise torque ( $T_{ccw}$ ) against slip(s)  
**(c)** – Plot for net torque ( $T_{net}$ ) against slip(s)  
**(d)** – Plot for the superposition of a, b, c against slip(s) (Obute KC et al, 2017)



**Fig 8** – Plot for efficiency against slip(s) for the transfer field motor

### 9 – Discussion Of Result/Analysis

The equivalent circuit of a single-phase transfer-field reluctance motor from which the performance indices can be predicted has been presented. Though, the single phase transfer field machine and the induction machine counterpart belong to two different class of machine and quite different in physical configuration, yet both display similar torque-slip and Efficiency-slip characteristics.

It may be noted that the torque-slip curves due to clockwise, counter clockwise and resultant magnetic fields have been drawn for a slip range of  $0.5 \leq s \leq 1.5$ . From fig. 7c, it is observed that;

- a. Net torque  $T_{net}$  at standstill of the rotor is zero. That is at slip  $s = 1$ . The torques developed by the clockwise and counter clockwise fields cancel each other. This is responsible for the non self starting ability of the motor.
- b. Assuming the rotor is given an initial rotation in any direction, the net torque developed causes the rotor to continue to rotate in the direction in which it is started

- c. As a corollary to a, the net torque can also be zero at some values of rotor speed below the synchronous speed.

Additionally, the machine suffers severe electrical losses which account for its low efficiency when compared to an equivalent single phase induction motor counterpart. This is as a result its excessive leakage reactance. In addition, the intersegment of conductors between the two machine sections contributes to the leakage reactance and does not in any way contribute to energy transfer in the machine.

Though as an asynchronous machine, the single phase transfer field machine is capable of synchronous operation when;

- (i) The auxiliary winding runs at half the source frequency or when the slip is half ( $s=0.5$ ) and a direct current is applied to the auxiliary winding to produce a d.c field at this speed (ie  $\omega = 0.5\omega$ )
- (ii) The auxiliary winding (rotor) is brought up to synchronous speed of applied field,  $\omega_s$ , by an auxiliary with the main and auxiliary windings of the transfer field machine connected to the supply. In this mode, the motor will operate as a synchronous machine utilizing one side of the coupled transfer field machine (Eleanya M.N. 2015)

### 10 – Suggested Areas Of Application, Recommendation And Conclusion

The transfer field machine in general is a low speed machine operating at half the speed of a normal induction machine (Agu L.A.1978). Single phase motor without rotating windings will have future in a variety or special applications such as very slow speed fixed frequency drives, linear motor for small scale transport systems etc. It is common knowledge that a low speed machine will find application in domestic appliances requiring low speed drives such as grinding machines for

perishables. However, many household are invariably supplied with single-phase, necessitating the development of single phase transfer field machine for the purpose of wider applications.

It is hoped that these identical characteristics of the single phase transfer field machine with that of the single phase induction machine counterpart should be harnessed to design and construct more robust transfer field machines, as this will increase its industrial acceptance as well as augmenting the role of induction machine as the work horse of the electric power industry. It is therefore recommended that detailed study should be carried out on the output power to size ratio of the transfer field machine. This will to a large extent help in the design and construction of a cheaper (TF) machine of variable sizes and ratings, for industrial and domestic applications.

However, the design analysis for the improvement in the efficiency of the machine is on the pipeline as it is being studied by us.

### Acknowledgement

The authors acknowledge God Almighty for his protection and their families for their endurance, tolerance and support during the research work.

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# Use of Static Synchronous Series Compensator (SSSC) In Hybrid System

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**Abstract-** The focus of this research work is on a FACTS device known as Unified Power Flow Controller (UPFC), which can provide simultaneous control of basic power system parameters like voltage, active power flow, reactive power flow, impedance and phase angle. In this research work, simulation models for different multi machine systems are carried out, e.g. a hybrid power system, a power system with two synchronized hydro power stations etc., without UPFC & with UPFC located at the load end of the power system, has been developed. Simulation models have been incorporated into MATLAB based Power System Toolbox (PST) for their voltage stability analysis. These models were analyzed for voltage, active power flow, and reactive power flow and phase angle, with and without UPFC. The results of the power system with UPFC and without UPFC are compared and the conclusion is given at the end., a power transfer capability of long transmission line is limited by stability consideration. Oscillation of generator angle or line angle are generally associated with the transmission system disturbances and can occur due to step changes in load, sudden change of generator output, transmission line switching and short circuit. Different modes of rotor oscillation are local mode, intra-area mode and inter-area mode. The frequency of oscillations of rotor swings varies from 0.2 to 4 Hz. The lower end of frequency spectrum corresponds to inter-area modes, in which a large number of generators participated and their damping is difficult. This low frequency is important to damp as quickly as possible because they cause mechanical wear in power plants and cause power quality problem. If the electromechanical oscillations are not properly controlled in the electric power system operation, it may lead to a partial or total system outage. Instability problems in power systems that can lead to partial or full blackout can be broadly classified into three main categories, namely voltage, phase angle and frequency related problems. In early age this signal instability problem was solved by amortisseurs (shock absorber) winding implemented in generator rotors, later with the application of fast excitation system this was solved by development & utilization of Power System Stabilizer (PSS) and however in modern power system due to the connection of power grids in vast area, for inter area oscillation damping due to the ability of controlling line impedance, power flow and bus voltage, Flexible AC transmission Systems (FACTS) devices implementation offers an alternative solution. The focus of this research work is on a FACTS device known as Unified Power Flow Controller (UPFC), which can provide simultaneous control of basic power system parameters like voltage, active power flow, reactive power flow, impedance and phase angle. In this research work, simulation models for different multi machine systems are carried out, e.g. a hybrid power system, a

power system with two synchronized hydro power stations etc., without UPFC & with UPFC located at the load end of the power system, has been developed. Simulation models have been incorporated into MATLAB based Power System Toolbox (PST) for their voltage stability analysis. These models were analyzed for voltage, active power flow, and reactive power flow and phase angle, with and without UPFC. The results of the power system with UPFC and without UPFC are compared and the conclusion is given at the end.

**Index Terms-** FACTS, STATCOM, Controller Design, PWM.

## I. INTRODUCTION

In today's high complex and interconnected power systems, there is a great need to improve power utilization while still maintaining reliability and security. Reducing the effective reactance of lines by series compensation is a direct approach to increase transmission capability. However, a power transfer capability of long transmission line is limited by stability consideration [13]. Oscillation of generator angle or line angle are generally associated with the transmission system disturbances and can occur due to step changes in load, sudden change of generator output, transmission line switching and short circuit [18]. Different modes of rotor oscillation are local mode, intra-area mode and inter-area mode. The frequency of oscillations of rotor swings varies from 0.2 to 4 Hz [2]. The lower end of frequency spectrum corresponds to inter-area modes, in which a large number of generators participated and their damping is difficult. This low frequency is important to damp as quickly as possible because they cause mechanical wear in power plants and cause power quality problem. If the electromechanical oscillations are not properly controlled in the electric power system operation, it may lead to a partial or total system outage [18]. Instability problems in power systems that can lead to partial or full blackout can be broadly classified into three main categories, namely voltage, phase angle and frequency related problems [3]. In early age this signal instability problem was solved by amortisseurs implemented in generator rotors, later with the application of fast excitation system this was solved by development & utilization of Power System Stabilizer (PSS) and however in modern power system due to the connection of power grids in vast area, for inter area oscillation damping due to the ability of controlling line impedance, power flow and bus voltage, Flexible AC transmission Systems (FACTS) devices implementation offers an alternative solution [19].

The focus of this research work is on a FACTS device known as Unified Power Flow Controller (UPFC), which can provide simultaneous control of basic power system parameters like voltage, active power flow, reactive power flow, impedance and phase angle. In this research work, simulation models for different multi machine systems are carried out, e.g. a hybrid power system, a power system with two synchronized hydro power stations etc., without UPFC & with UPFC located at the load end of the power system, has been developed. Simulation models have been incorporated into MATLAB based Power System Toolbox (PST) for their voltage stability analysis. These models were analyzed for voltage, active power flow, and reactive power flow and phase angle, with and without UPFC. The results of the power system with UPFC and without UPFC are compared and the conclusion is given at the end.

## II. LITERATURE REVIEW

A number of Flexible Alternating Current Transmission System (FACTS) controllers are available today due to the rapid development in the field of power electronics. Generally, each of these controllers can act only on one of the three parameters (voltage, impedance and angle), that determine the power flow through a transmission line. But Unified Power Flow Controller (UPFC) is such a versatile FACTS device that has the capability of controlling all the three parameters simultaneously. With the rapid development of power electronics, it is possible to design power electronic equipment of high rating for high voltage systems, the voltage stability problem resulting from transmission system may be, at least partly, improved by use of the equipment well-known as FACTS-controllers.

In the transmission area, application of power electronics consists of HVDC power transmission and FACTS. HVDC is an economical way to interconnect power systems, which are situated in different regions and separated by long distances or those which have different frequencies. HVDC involves conversion of ac to dc at one end and conversion of dc to ac at the other end. Also, there is a widespread use of microelectronics, computers and high speed communication for control & protection of present transmission system. [2], [4]

FACTS being a new technology will play the principal role to enhance controllability and power transfer capability in an ac system. FACTS technology is not a single high power controller, but rather a collection of controllers, which can be applied individually or in coordination with others to control one or more of the interrelated system parameters. This technology has opened up new opportunities for controlling power and enhancing the usable capacity of present, as well as new and upgraded lines. Current through a line can be controlled at a reasonable cost enabling a large potential of increasing the capacity of the existing line and the use of FACTS controllers to enable the corresponding power to flow through such lines under normal and contingency conditions.

There are basically two type of analysis i.e. component oriented and system orientated. In the component orientated analysis, individual physical elements of a FACTS-controller are concerned. On the other side, the system orientated analysis needs answers on achievements that could be possibly gained by using a FACTS-controller. This research work is solely

concerned with system wise aspects of the FACTS technology. In general form, system wise aspects are related to the enhancements of transmission network capability.

## III. BASIC TYPES OF FACTS CONTROLLER

FACTS controller can be classified into four categories:

- a) Series Controller (e.g. Static Synchronous Series Controller (SSSC))
- b) Shunt Controller (e.g. STATCOM, D-STATCOM)
- c) Combined Series – Series Controller
- d) Combined Series – Shunt Controller (e.g. Unified Power Flow Converter (UPFC))

FACTS devices are used as power flow controller and the voltage source converter in a line ultimately resulting into oscillation damping. Series controllers are used to control power flow and oscillations damping in a line. Shunt devices are effective to control voltage. UPFC is a series-shunt controller that can control active & reactive power, voltage through a line. UPFC can also be used to analyze transient stability of a single machine system. [1], [2], [3], [4], [5]

The maintenance and reliability of the power system has become a major aspect of study. Present power systems have become complex and heavily loaded, due to which voltage instability has become a serious problem, leading to Voltage Instability a cause of system collapse from which the system cannot recover. The encouragement to the construction of HV lines, the amount of power transmission/km on HV line and the amount of power transaction as seen from economic side is much responsible for concern towards congestion in power system. Main reason for the cause of voltage instability is the sag in reactive power at various locations in an interconnected power system. Real and Reactive power compensation in transmission systems improve the voltage stability of the AC system and can avoid voltage collapse. The unified power flow controller (UPFC) is a pair of back to back power electronic inverters which control the real and reactive power flow in a transmission line. Maximum power transfer capability is achieved when the UPFC is operated at its rated capacity and conventional voltage and line-flow set point regulation is no longer possible. The voltage stability L- index and 3 line stability is used for operating the UPFC at rated capacity so as to optimize the power transfer. [6], [8], [13], [20], [23], [24]

A Unified Power Flow Controller (UPFC) is a typical FACTS device capable of instantaneous control of three system parameters. Unified Power Flow Controller (UPFC) is able to control both the transmitted real power and the reactive power flows at the sending- and the receiving-end, at the midpoint of the transmission line. A control structure with a predictive control loop and pre control signal for a dc-voltage control is used for better stability and transient performance of UPFC, in comparison with the classical decoupled strategy. [5], [6], [14], [15], [18]

Generation of electricity using wind power has received considerable attention worldwide in recent years. In the beginning, the wind energy was used for standalone purposes. But as the power demand is growing day by day, there is a need for connecting this wind power to the grid. A lot of methods are adopted for connecting this power to the grid. Here is also one

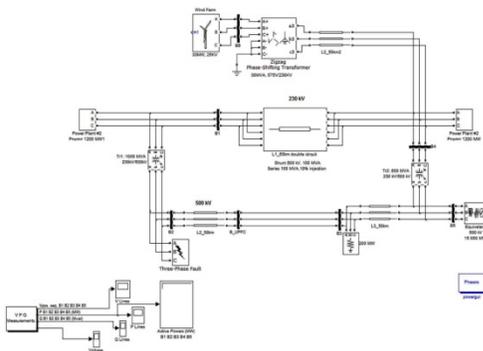
strategy which can be used for connecting this wind energy to the grid. And after connecting to the grid, the analysis is done. [9], [10], [11]

The Unified Power Flow Controller (UPFC), with its unique combination of fast shunt and series compensation, is a powerful device which can control three power system parameters. In planning and designing such devices in power systems, power engineers must consider the impact of device internal limits on its performance. [20], [21]

#### IV. SIMULATION MODELS FOR PERFORMANCE ANALYSIS OF UPFC

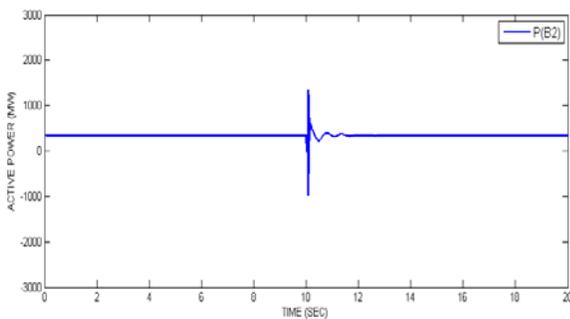
##### 4.1 CASE- HYBRID POWER SYSTEMS

##### 4.1.1 Without UPFC under 3-Phase to Ground Fault Condition

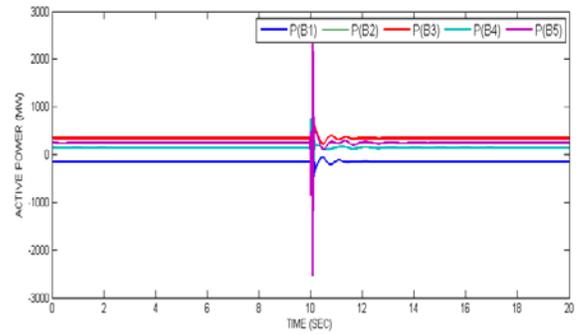


**Fig.4.1. A hybrid power system under 3-phase to ground fault condition without UPFC**

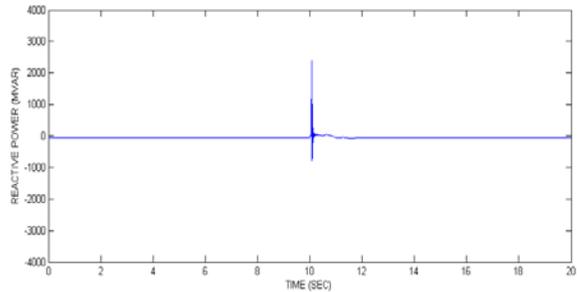
A three phase to ground fault is created at  $t=10$  sec for 0.08 sec at bus 2 as shown in fig. 4.1. The active power, reactive power, voltage and phase angle curves with respect to time at all five buses (B1 B2 B3 B4 B5) are shown in fig. 4.1.1-4.1.8



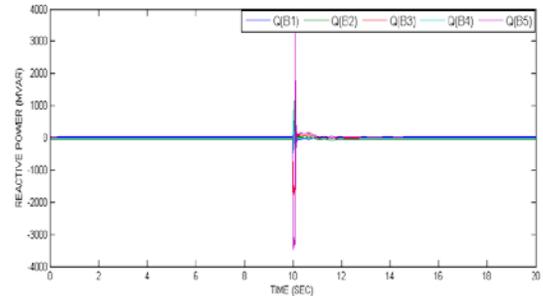
**Fig.4.1.1. Active power at bus B2**



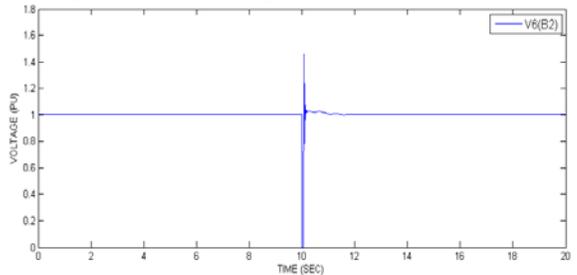
**Fig. 4.1.2. Active power at different buses**



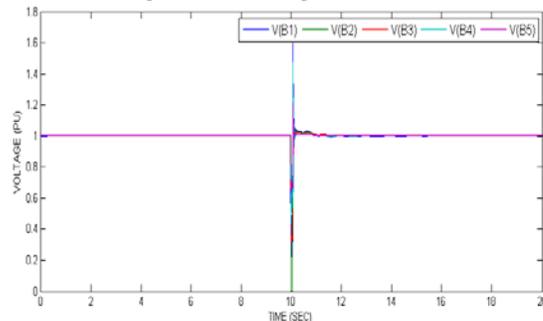
**Fig. 4.1.3. Reactive power at bus B2**



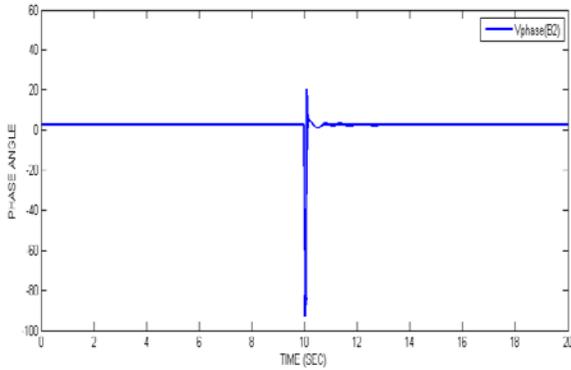
**Fig. 4.1.4. Reactive power at different buses**



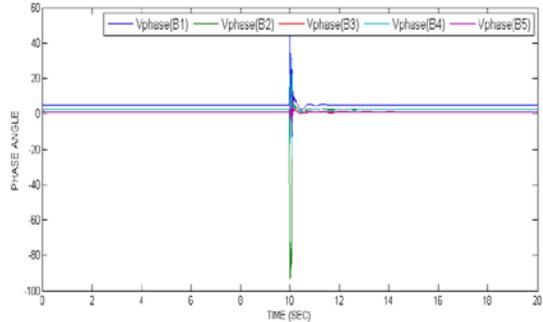
**Fig. 4.1.5. Voltage at bus B2**



**Fig. 4.1.6. Voltage at different buses**

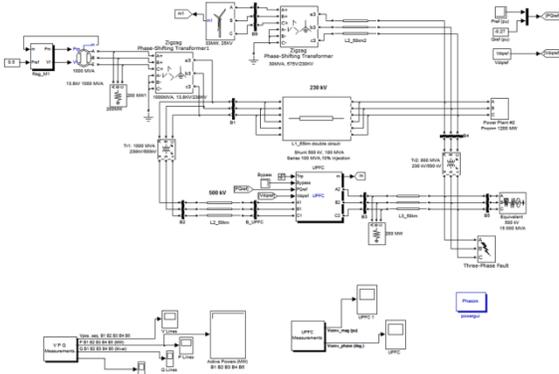


**Fig. 4.1.7. Phase angle at bus B2**



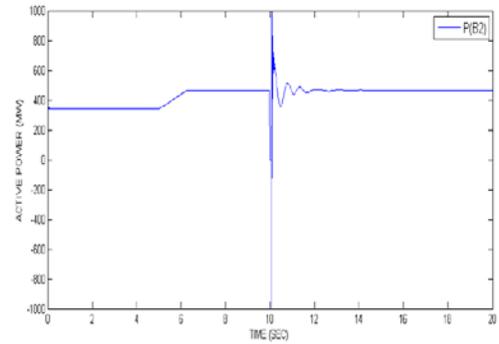
**Fig. 4.1.8. Phase angle at different buses**

4.1.2 Using UPFC Under 3-Phase to Ground Fault Condition

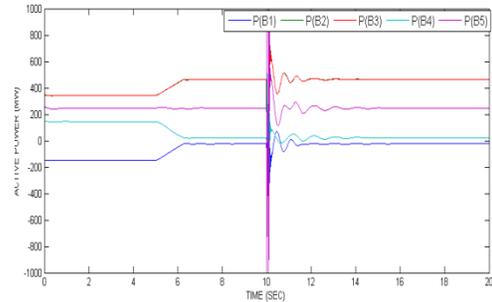


**Fig. 4.2.A hybrid power system using UPFC under 3-phase to ground fault condition**

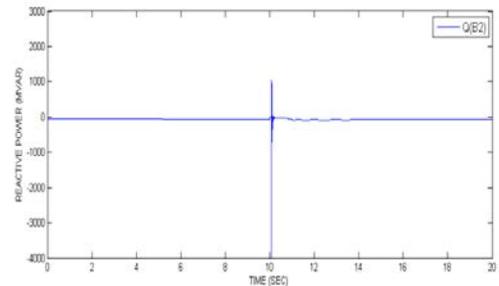
A three phase to ground fault is created at  $t=10$  sec for 0.08 sec at bus 2 as shown in fig. 4.2. The ratings of the various components used are given in appendix-F. The UPFC is made on at  $t=8$ sec and the power flow in the system goes from 5.87pu to 6.87pu. The active power, reactive power, voltage and phase angle curves, voltage at UPFC with respect to time at all five buses (B1 B2 B3 B4 B5) are shown in fig. 4.2.1-4.2.8.



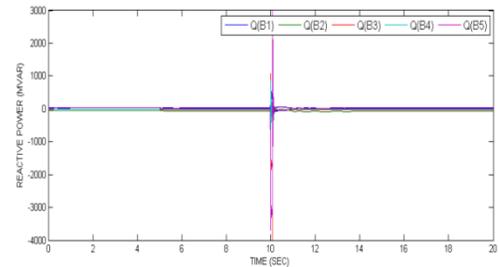
**Fig.4.2.1. Active power at bus B2**



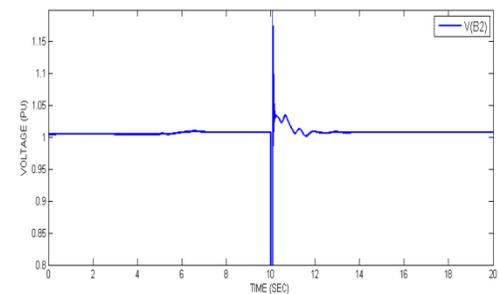
**Fig. 4.2.2. Active power at different bus**



**Fig. 4.2.3. Reactive power at bus B2**



**Fig. 4.2.4. Reactive power at different bus**



**Fig. 4.2.5. Voltage at bus B2**

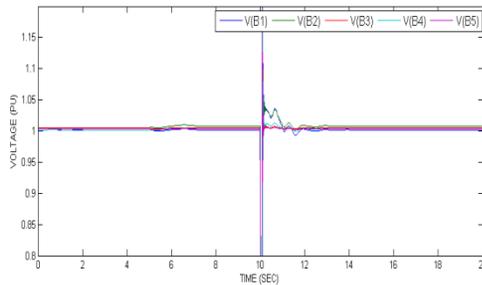


Fig. 4.2.6. Voltage at different bus

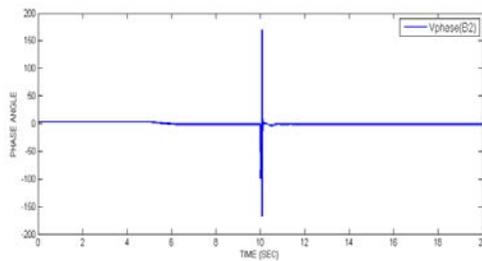


Fig. 4.2.7. Phase angle at bus B2

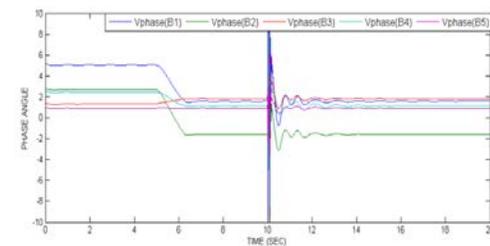


Fig. 4.2.8. Phase angle at different buses

## V. EXPERIMENTAL RESULTS AND DISCUSSIONS

Active Power Flow (MW)		
Buses	Without UPFC	With UPFC
Bus 1	-24.94	-24.32
Bus 2	464.28	464.25
Bus 3	462.98	463.17
Bus 4	18.60	20.44
Bus 5	241.35	243.44

Here as can be seen from the table that the UPFC don't have much impact on the active power flow of the system but in case of fault, the oscillations produced in the system are much less in magnitude and also the time of clearing the fault is less when the system is provided with UPFC. Similarly, we can find values of Reactive Power Flow and Phase angle with and without UPFC.

## VI. CONCLUSION

In the simulation study, Matlab Simulink environment is used to simulate the model of UPFC connected to a 3phase system. The modeling of UPFC and analysis of powersystems embedded with UPFC has been presented, which is capable of solving large power networks very reliably with the UPFC. The investigations related to the variation of control parameters and

performance of the UPFC on power quality results are carried out. In 22 kv study, the MATLAB environment using phasor model of UPFC connected to a three phase-three wire transmission system. This paper presents control and performance of UPFC intended for installation on a transmission line. Simulation results show the effectiveness of UPFC incontrolling real and reactive power through the line.

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# Study on Fish Productivity in Bichhiya River and Govindgarh Lake of district Rewa, Madhya Pradesh

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## ABSTRACT

Freshwater fish populations are of major ecological and economic importance. Fish play a major economical role in structuring the benthic and zooplanktonic invertebrate communities. Primary productivity is the most important biological phenomenon in nature, which involves the trapping of radiant energy of the sun and its transformation into high potential biochemical energy by the process of photosynthesis. The productivity of freshwater fish species of Bichhiya River and Govindgarh Lake in Rewa district was studied from October 2009 to September 2010.

**Keywords** –Primary Productivity, Bichhiya River and Govindgarh Lake.

## INTRODUCTION

Water is essential for all socioeconomic development and for maintaining healthy ecosystems. Natural surface water bodies like rivers and streams are subjected to pollution comprising of organic and inorganic constituent. [1]

Rivers are the most important sources of water to global population. Rivers provide water for industry, agriculture, commercial, aquaculture and domestic purposes. Unfortunately this important source of water is being polluted by indiscriminate disposal of sewage, industrial wastes and plethora of human activities. The significant role played by river in almost in every development programm of country hardly needs many elaborations. Lakes play an important role in the development programmes of country. They can serve as sources of drinking and for industries for agriculture, power development and fisheries. Unfortunately domestic wastes from human settlement and industrial effluents pollute majorities of our lakes and river system. [2]

A study of fresh water habitat with special reference to fish productivity useful for quick development and growth of the fishes. The importance of primary productivity is also well realised practically culture programmes. Therefore, it is essential to carry out intensive studies in the lake and river also extensive studies of the water of the region to obtain a thorough knowledge of biological productivity in waters of the region for promoting pisciculture [3]. Although various workers have contribution in the field of limnology in various parts of our country, yet most of the part of Madhya Pradesh remained neglected. Especially no extensive work has been done with the fish growth and productivity of lake and Bichiya River of Rewa Division, Madhya Pradesh is rich in fresh water resources. It is estimated that, 59,887 hectares of water body is readily available for fish culture.

## MATERIALS AND METHODS

### Study sites

The study area is situated between 81°-18' east longitude and 28°-32' north latitude and is situated on Vindhya plateau at the height of 318 meter above m. s. l. The climate is mainly sub tropical and sub humid. The average annual rainfall of the region is 82.953 mm and relative humidity is 79.36 %. Two water bodies namely Bichhiya River and Govindgarh Lake were selected for study, because of their contribution to the development of fresh water culture fishery of Rewa district. The Govindgarh Lake is located 24°-20' 25'' longitude and 81°-15' 20'' latitude of Rewa district while Bichhiya River is located on 24°-10' N and 81°-15' longitude east of Rewa town.

### Sampling Station

Four sampling station were selected for physical analysis of river. They are-

**Station 1<sup>st</sup>** - The 1<sup>st</sup> station was Gurh where the river Bichhiya originated. It is about 27k.m. away From Rewa town.

**Station 2<sup>nd</sup>** - The 2<sup>nd</sup> station was established at Laxman Bag Mandir 6 km away from Rewa District.

**Station 3<sup>rd</sup>** - The 3<sup>rd</sup> station was established before Rajghat the characteristics of the station is PHE Deptt. Pumping.

**Station 4<sup>th</sup>** - The 4<sup>th</sup> station was marked on Chhotipul which is half km from Old Rewa Bus Stand.

The four sampling station were selected after preliminary observation of Lake for the purpose of present study. The four sampling site for present investigation as A, B, C and D water sample were collected from all these four station,

**1<sup>st</sup> Sampling station A** - Fort - This is a point located east of the lake.

**2<sup>nd</sup> Sampling station B** - Corner of Lake

**3<sup>rd</sup> Sampling station C** - Gopal Bag - This site is situated at centre of the lake.

**4<sup>th</sup> Sampling station D** - Fish form

### Primary Production

Primary Production was determined by the direct measurement of photosynthesis specially by phytoplankton. For this purpose 'Light and dark Oxygen methods' was employed.

Clear bottle (CB), a dark bottle (DB) and a clear bottle (LB) were filled with the sample water. Just before starting the experiment the oxygen of the bottle (CB) was fixed. Clear and dark bottles were suspended in water. The bottle (DB) and (LB) were allowed to remain suspended in water for 4 hrs. After that bottles were removed and their oxygen was fixed on the spot. The fish growth and productivity of river and lake was calculated by applying Ricker (1946) [4] formula.

### Calculation

$$\text{Net Primary Production} = \frac{\text{LB}-\text{CB} \times 0.375}{\text{---}} \times t$$

## PQ

0.375 was a factor for converting oxygen values to carbon values.

PQ was photosynthetic coefficient = 1.2

t = Incubation period.

The values of gross and net production were obtained in  $\text{gc/m}^2/\text{day}$  using a photoperiod of 12 hours.

## RESULTS AND DISSCUTION

### Primary Productivity:

Water is an incredibly important aspect of our daily life. Every day we drink water, cook with water, bath in water and participate in many activities involving water. It is essential for all dimensions of life. Table 1 and 2 shows the monthly primary production.

### In Bichhiyariver :

**Station S<sub>1</sub>** :At the surface level the maximum values of Net primary production was noted in December was  $3.000 \text{ gc/m}^2/\text{day}$  and the minimum values at surface in August was  $0.897 \text{ gc/m}^2/\text{day}$ . At 1 meter depth net primary production was zero in the month of July and September. At 2 meters & 3 meters depth production were undertaken zero throughout the year. (Table 1)

**Station S<sub>2</sub>** : The maximum values of the net primary production at surface level and 1 meter depth were noted in December were  $3.224 \text{ gc/m}^2/\text{day}$  and  $2.984 \text{ gc/m}^2/\text{day}$  respectively. The minimum values for the same levels were  $0.320 \text{ gc/m}^2/\text{day}$  and  $1.436 \text{ gc/m}^2/\text{day}$  in the month of August respectively. At surface & 1 meter level net production were zero in the month of September. At the depth of 2 & 3 meters net primary production were zero in the month of September. (Table 1)

**Station S<sub>3</sub>**: The highest values of the net primary productionn at the surface and 1 meter depth noted in the month of January  $3.689 \text{ gc/m}^2/\text{day}$  and  $3.468 \text{ gc/m}^2/\text{day}$  respectively. The lowest value at the same level were  $0.825 \text{ gc/m}^2/\text{day}$  and  $1.000 \text{ gc/m}^2/\text{day}$  in August and June respectively. At 2 & 3 meters depth net primary production were not detected through out the year. At surface level net production was zero in the month of September and at the 1 meter depth the production were zero in the month of August and September. (Table 1)

**Station S<sub>4</sub>** : The maximum values of the net primary production at the surface and 1 meter level noted in the month of December i.e.;  $2.940 \text{ gc/m}^2/\text{day}$  and  $2.144 \text{ gc/m}^2/\text{day}$ . The minimum values at same levels noted in the month of August & June were  $0.565 \text{ gc/m}^2/\text{day}$  and  $0.338 \text{ gc/m}^2/\text{day}$  respectively. The value of net production was not noted in the month of September throughout the year, but at the 1 meter depth in the month of August and September were zero also. (Table 1)

### In Govindgarhlake :

**Station A** :At the surface level the maximum values of net primary production noted in December was  $6.822 \text{ gc/m}^2/\text{day}$  and the minimum values at the surface in August was  $1.080 \text{ gc/m}^2/\text{day}$ . At 1 meter depth net primary production was zero in the month of

July and September. At 2 meter depth production was noted in month of November 1.560 gc/m<sup>2</sup>/day, Dec. 2.740 gc/m<sup>2</sup>/day, in January 1.975 gc/m<sup>2</sup>/day and in March 1.975 gc/m<sup>2</sup>/day respectively and at 3 meters depth it was undertaken zero throughout the year. (Table 2)

**Station B :** The maximum values of the net primary production at surface level and 1 meter depth noted in December were 4.678 gc/m<sup>2</sup>/day and 2.922 gc/m<sup>2</sup>/day day respectively. The minimum values for the same levels were .360 gc/m<sup>2</sup>/day and .936 gc/m<sup>2</sup>/day in the month of August respectively. At surface level & 1 meter level net primary production was zero in July at 2 meters depth in the month of July & September was zero. At 2 meters depth net primary production was detected in November 1.500 gc/m<sup>2</sup>/day and in December 1.610 gc/m<sup>2</sup>/day respectively.(Table 2)

**Station C:** The highest values of the net primary productionn at the surface and 1 meter depth noted in December 5.045 gc/m<sup>2</sup>/day and 6.000 gc/m<sup>2</sup>/day respectively. The lowest value at the same level is 560 gc/m<sup>2</sup>/dayand 1.040 gc/m<sup>2</sup>/day in the month of August respectively. At surface level net production was zero in the month of July. At 2 meters depth were noted in November 1.500 gc/m<sup>2</sup>/day, in December 1.860 gc/m<sup>2</sup>/day, and in March .260 gc/m<sup>2</sup>/day respectively. At 3 meters depth net primary productivity was not detected throughout the year. (Table 2)

**Station D :** The highest value of the net primary production at the surface and at 1 meter depth noted in December 6.376 gc/m<sup>2</sup>/day and 6.000 gc/m<sup>2</sup>/day respectively. The lowest values at same levels noted in August were 1.270 gc/m<sup>2</sup>/day and 0.480 gc/m<sup>2</sup>/day respectively. The value of net production was not marked in the month of July & September at surface level as well as 1 meter depth. At 2 meters depth net primary production was noted in the months of Novmber 1.450 gc/m<sup>2</sup>/day, December 2.550 gc/m<sup>2</sup>/day, and in March 1.120 gc/m<sup>2</sup>/day respectively. At 3 meters depth net primary production was not detected throughout the year. (Table 2)

Vermaet *al.* (1980) [5] reported that intrafish competition might have further reduced their population. Mention may be made that fish population is greatly influenced by different biotic, abiotic components and tropic niche of aquatic ecosystems. Most of the herbivorous fishes, due to grazing effect influence the phytoplankton population of grazing is more detrimental to phytoplankton and less hazardous to zooplankton.

**Table 1- Monthly data of Net primary production (gc/m<sup>2</sup>/day) of Bichhiyariver(Oct. 2009 to Sept. 2010)**

Months	Station	0m.	1m.	2m.	3m.
Oct.	S <sub>1</sub>	2.740	2.620	00	00
	S <sub>2</sub>	2.920	2.880	00	00
	S <sub>3</sub>	2.446	2.000	00	00
	S <sub>4</sub>	1.098	1.026	00	00
	S <sub>1</sub>	2.224	1.792	00	00
	S <sub>2</sub>	2.229	2.886	00	00

Nov.	S <sub>3</sub>	1.699	1.098	00	00
	S <sub>4</sub>	1.233	1.008	00	00
Dec.	S <sub>1</sub>	3.000	2.966	00	00
	S <sub>2</sub>	3.224	2.984	00	00
	S <sub>3</sub>	2.665	2.205	00	00
	S <sub>4</sub>	1.779	1.670	00	00
Jan.	S <sub>1</sub>	2.768	2.608	00	00
	S <sub>2</sub>	2.964	2.745	00	00
	S <sub>3</sub>	2.060	2.000	00	00
	S <sub>4</sub>	1.220	1.000	00	00
Feb.	S <sub>1</sub>	2.240	2.048	00	00
	S <sub>2</sub>	2.432	2.243	00	00
	S <sub>3</sub>	1.866	1.224	00	00
	S <sub>4</sub>	1.078	1.050	00	00
Mar.	S <sub>1</sub>	2.086	2.021	00	00
	S <sub>2</sub>	2.133	2.035	00	00
	S <sub>3</sub>	1.506	1.112	00	00
	S <sub>4</sub>	1.024	1.006	00	00
Apr.	S <sub>1</sub>	2.126	2.046	00	00
	S <sub>2</sub>	2.176	2.109	00	00
	S <sub>3</sub>	1.306	1.072	00	00
	S <sub>4</sub>	1.114	1.005	00	00
May	S <sub>1</sub>	1.298	1.095	00	00
	S <sub>2</sub>	1.445	1.121	00	00
	S <sub>3</sub>	1.053	1.003	00	00
	S <sub>4</sub>	1.004	1.623	00	00
Jun.	S <sub>1</sub>	1.063	1.836	00	00
	S <sub>2</sub>	1.165	1.109	00	00
	S <sub>3</sub>	1.025	1.002	00	00
	S <sub>4</sub>	0.823	0.523	00	00
Jul.	S <sub>1</sub>	1.853	00	00	00
	S <sub>2</sub>	2.086	00	00	00
	S <sub>3</sub>	00	00	00	00
	S <sub>4</sub>	00	00	00	00
Aug.	S <sub>1</sub>	0.897	1.006	00	00
	S <sub>2</sub>	0.320	1.436	00	00
	S <sub>3</sub>	0.360	0.268	00	00
	S <sub>4</sub>	0.280	0.170	00	00
	S <sub>1</sub>	1.820	00	00	00
	S <sub>2</sub>	1.425	00	00	00

Sept.	S <sub>3</sub>	1.257	00	00	00
	S <sub>4</sub>	0.700	00	00	00

**Table 2- Monthly data of Net primary production (gc/m<sup>2</sup>/day) of Govindgarh lake (Oct. 2009 to Sept. 2010)**

Months	Station	0m.	1m.	2m.	3m.
Oct.	A	4.845	4.140	00	00
	B	3.740	2.780	00	00
	C	4.400	3.080	00	00
	D	4.621	4.000	00	00
Nov.	A	6.530	5.740	1.560	00
	B	3.320	2.000	1.206	00
	C	4.510	3.346	1.500	00
	D	5.410	2.580	1.450	00
Dec.	A	6.822	6.020	2.740	00
	B	4.678	2.922	1.610	00
	C	5.476	3.760	1.860	00
	D	6.376	6.000	2.550	00
Jan.	A	5.112	4.800	2.075	00
	B	4.440	3.500	00	00
	C	5.045	3.678	00	00
	D	5.110	3.710	00	00
Feb.	A	5.890	5.260	00	00
	B	4.108	3.670	00	00
	C	4.190	5.030	00	00
	D	5.115	4.880	00	00
Mar.	A	4.170	3.242	1.975	00
	B	3.312	2.880	00	00
	C	4.035	4.048	0.260	00
	D	4.850	4.038	1.120	00
Apr.	A	4.340	4.000	00	00
	B	2.328	2.100	00	00
	C	4.300	4.095	00	00
	D	5.070	4.620	00	00
May	A	3.040	1.695	00	00
	B	1.630	1.045	00	00
	C	2.235	1.026	00	00
	D	1.898	1.520	00	00
Jun.	A	2.165	2.144	00	00
	B	1.155	1.000	00	00
	C	2.090	1.440	00	00

	D	2.080	2.198	00	00
Jul.	A	2.170	00	00	00
	B	00	00	00	00
	C	00	00	00	00
	D	2.140	00	00	00
Aug.	A	1.080	1.156	00	00
	B	0.360	0.936	00	00
	C	0.560	1.040	00	00
	D	1.270	0.480	00	00
Sept.	A	1.875	00	00	00
	B	1.440	00	00	00
	C	1.350	00	00	00
	D	1.700	00	00	00

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# Phytochemical Investigation of *Santalum album* Leaves and Fruits

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## ABSTRACT

*Santalum album* commonly known as Sandalwood is used traditionally for health and wellness. It is an evergreen and hemi-parasitic tree and has a long history in Indian religious rituals and traditional Chinese medicine. Due to its wide application in cosmetics and therapeutics, we have done this study to explore the possibility of using aqueous extract of *S. album* from leaves and fruit for Phytochemical screening of these plants was performed for constituents indicated the presence of alkaloids, carbohydrates, tannin and phenolic compound, flavonoids, glycoside, amino acids, Inorganic acid and steroids. The results suggest that the Phytochemical properties of the leaf for using various ailments.

**Key word:** Phytochemical, *Santalum album*, leaves and fruits.

## INTRODUCTION

*Santalum album* Linn. is one of the important herbal plant used in ayurveda for the treatment of various diseases. It is member of family Santalaceae and commonly known as sweta chandan. It is widely distributed in throughout the India especially in Indo-Malesian region and in the dry regions of peninsular India. Though it is naturalized in many parts of India i.e. in Vindhya Mountains southwards, also in Karnataka, Andhra Pradesh and Tamilnadu; it is cultivated for its aromatic wood and oil. (Abhijit, et al, 2015)

Sweta chandan is a small to medium sized, evergreen semi-parasitic tree, with slender branches, sometimes reaching up to 18 m in height and 2.4 m in girth. Bark reddish or dark grey or nearly black, rough with deep cracks on old trees; leaves glabrous, thin, elliptic-ovate or ovate-lanceolate, 1.5-8 cm 1.6-3.2 cm, sometimes larger; flowers straw-coloured, brownish purple, reddish purple or violet. Sandal is capable of growing in different kinds of soil like sand, clay, laterite, loam, black-cotton etc. (Brunke, 1995)

It is capable of regenerating profusely in the absence of fire and grazing. Sandalwood is used for acute dermatitis, bronchitis, cystitis, eye diseases, gonorrhoea, herpes, zoster, infection, palpitations, sunstroke, urethritis, vaginitis, psychopathic, Skin disorders, Heart ailments, Anti-pyretic, General weakness, Urinary tract infection and many more ( Shankaranaryana, 1986). Here an attempt has been made to investigate the chemical present in the plant for curing various diseases.

## MATERIAL AND METHODS:

### Selection of plant material for study:

In present work *Santalum album Linn.* (Sweta chandan) have been selected for the study. It has been collected from civil line rewa of Rewa district (M.P.). The plant has identified on the basis of different pharmacopeial and botanical standard. Mostly extract of leaf and fruit has been used in the study.

### Extraction:

The plant materials were washed under running water, cut into pieces, air shade dried and pulverized into fine powder in a grinding machine. A quantity of 100g of the dried powder of seed and leaves powder extracted individually with different individual solvent ie. Chloroform, Ethanol and Water respectively using Soxhlet. The soxhletion with Aqueous were due for a week to obtained extract. After that, the Extract was evaporated in water bath at 50 °C to obtained crude for antioxidant assay, phytochemical analysis, Determination of Bioactive compound.

### Phytochemical Analysis:

Phytochemical analysis is a major procedure for estimation of particular chemical compound. Phytochemical analysis was preceded by the help of different specific method for each test. (Christopher et al, 2006)

## RESULTS AND DISCUSSION

The phytochemical constituents of the plants are summarized in table 1. These bioactive compounds are known to act by different mechanism and exert antimicrobial action. Glycosides serve as defence mechanisms against predation by many microorganisms, insects and herbivores. Alkaloids are formed as metabolic byproducts and have been reported to be responsible for the antibacterial activity. Steroids have been reported to have antibacterial properties, the correlation between membrane lipids and sensitivity for steroidal compound indicates the mechanism in which steroids specifically associate with membrane lipid and exerts its action by causing leakages from liposomes. ( Shankaranaryana et al,1981)

**Table - 1 Phytochemical Investigation of Chandan Plant Samples**

S.No.	Phytochemical test	Chandan leaf	Chandan friut
1.	<u>Carbohydrate</u> a) Molish test	-ve	+ve

	b) Cobalt chloride	+ve	+ve
2.	<b><u>Protein</u></b>		
	a) Million test	-ve	-ve
	b) Biuret test	-ve	-ve
	c) Xanthoprotein test	-ve	-ve
3.	<b><u>Steroids</u></b>		
	a) Salkowski reaction	+ve	-ve
4.	<b><u>Tanic acide for starch</u></b>	+ve	-ve
5.	<b><u>Test for nitrate</u></b>	-ve	-ve
6.	<b><u>Test for Flavonoid</u></b>		
	a) Flavonoid test	+ve	+ve
7.	<b><u>Test for Alkaloids</u></b>		
	a) Mayers test	+ve	+ve
	b) Wagner test	+ve	+ve
8.	<b><u>Test for Amino acide (cystein)</u></b>	-ve	-ve
9.	<b><u>Tannic &amp; phenolic compound</u></b>		
	a) 5% Fecl <sub>3</sub> sol <sup>n</sup>	+ve	+ve
	b) Lead acetate sol <sup>n</sup>	+ve	-ve
	c) Dil. iodene sol <sup>n</sup>	-ve	-ve
	d) Acetic acid sol <sup>n</sup>	-ve	+ve

<p><b>10.</b></p>	<p style="text-align: center;"><b><u>Inorganic acid</u></b></p> <p>a) Test for carbonet</p> <p>b) Murcuric chloride solution</p>	<p style="text-align: center;"><b>+ve</b></p> <p style="text-align: center;"><b>-ve</b></p>	<p style="text-align: center;"><b>+ve</b></p> <p style="text-align: center;"><b>-ve</b></p>
<p><b>11.</b></p>	<p style="text-align: center;"><b><u>Test for redusing polysccharide starch</u></b></p>	<p style="text-align: center;"><b>-ve</b></p>	<p style="text-align: center;"><b>-ve</b></p>

## CONCLUSION

*Santalum album* leaves and fruits extract made in solution contains different secondary metabolites with biological activity that can be of therapeutic index. Phytochemical screening of crude extract shows the presence of alkaloids, Carbohydrates, tannins, phenols, and steroids, and, flavonoids. The consequences of this work has clarified that many active bioconstituents of *Santalum album* consist effective qualities in its tending action. Therefore it should be exploited by scientists in development of human medicines and drugs.

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# The Physico-Chemical Characteristics of Different Textile Dyeing Effluents and Their Influence on the Total Protein Levels of Dragonfly Larvae *Bradinopyga Geminata*

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## ABSTRACT

The textile dyeing units of Pallipalayam area of Namakkal District play a vital role in polluting the river Cauvery directly and spoiling the underground water levels indirectly by letting off their dyeing effluents. This leads to serious environmental hazards of aquatic organisms. In the present study, the textile dyeing effluents of six major textile dyeing units (ST1, ST2, ST3, ST4, ST5 and ST6) were selected, analysed the physico-chemical parameters and their impact on the total muscle protein levels of the dragonfly larvae *Bradinopyga geminata*. From the results it was observed that the textile dyeing effluent of six stations contain high level of several organic and inorganic pollutants, which include toxic metals and chemicals. The levels of proteins were observed in decreasing trend in all the concentrations of effluent in different larval stages. It was concluded that the improper/without treatment of effluent when let out would result in adverse effects on aquatic and terrestrial ecosystems.

**Key words:** Textile dyeing effluent, *Bradinopyga geminata*, muscle protein.

## I. INTRODUCTION

Pollution in the river Cauvery is a big and perennial problem. Pallipalayam is a small town of Namakkal district which is situated at the banks of river Cauvery, contributes a lot in polluting the river by discharging the textile dyeing effluents of numerous textile dyeing units that are functioning in and around the town. The effluents are almost untreated and finally merge with the river water along with the sewage drains. For the past two decades the revolution in textile industry induced the proliferation of countless textile processing units in this area and polluted the river by their effluents beyond control.

The textile dyeing effluents carry dyes particularly harmful synthetic dyes such as direct dyes, mordant dyes, vat dyes, sulfur dyes, insoluble azo dyes and fibre-reactive dyes are the widely used common dyes to dye cellulosic fibres for dyeing and colouring process (Herman and Fletcher, 1966) and also used a number of chemicals in the textile processing units, like sulphur, naphthol, nitrates, acetic acid, soaps, enzymes, chromium compounds and heavy metals like copper, arsenic, lead, cadmium, mercury, nickel, cobalt and certain auxiliary chemicals. Synthetic dyes and other chemicals are complex substances most of them produce adverse effects on all forms of living/non-living things. The chemicals are

discharged as waste water and contribute to the effluents strong colour, high temperature, turbidity, varying pH, high COD and BOD levels, increased turbidity, high level of suspended solids and total dissolved solids and the toxic nature of the effluents proves fatal to the aquatic organisms directly or indirectly (Elango, 2017). The textile dyeing effluents induce many diseases in human beings and animals. Reactive dyes cause allergic dermatoses, respiratory diseases, mutagenicity (Rannung *et al.*, 1992), genotoxicity (Wollin and Gorlitz, 2004), embryo teratogenic effects (Birhanliet *et al.*, 2005), etc. The detergents, starches and other chemicals generate toxic metabolites which are poisonous to fish and other aquatic animals (Sun and Hu, 2014).

Aquatic insects like dragonfly larvae are considered as an excellent ecological indicator in monitoring water quality worldwide, as it is susceptible to anthropogenic changes of aquatic systems. The study of the dragonfly larvae can reveal the physico-chemical changes in aquatic ecosystems more quickly than studying any other animal or plant.

The impacts of the pollutants are best reflected in insect physiology and biochemistry, and can be successfully used as bio-indicators to monitor the environmental pollutions by metal contaminants and other pollutants (Davis *et al.*, 2001; Saunders *et al.*, 2002; Chen *et al.*, 2005; Lee *et al.*, 2006). The extended larval duration of the larvae and comparatively larger body size make it easy to study the chronic effects of the effluent. Hence, the larvae of *Bradinopyga geminata* are used in the present investigation to study the impact of effluents of textile dyeing industries.

## II. MATERIALS AND METHODS

### Collection and characterization of textile dyeing effluent

The textile dyeing effluents were collected from six stations namely, Aavarankadu (ST1), Pallipalayam (ST2), Aavathipalayam (ST3), Komarapalayam (ST4), VEDIYARASANPALAYAM (ST5) and Kaliyanur (ST6) of Namakkal District, Tamil Nadu, India. The collected effluent samples were subjected to analyses of physico-chemical parameters such as colour, odour, pH, EC, BOD, COD, TDS, TSS, total nitrogen, total phosphorous, total potassium, chloride, sodium, sulphate, calcium, magnesium, cadmium, lead, copper, zinc and chromium as per standard methods (APHA, 2005).

### Collection and identification of larval stages of *Bradinopygageminata*

The different larval stages of the dragonfly larvae were collected from their natural breeding sites such as irrigation tanks from Thiruchengode of Namakkal District, Tamil Nadu, India, using hand nets and brought to the laboratory. The larvae of *Bradinopygageminata* have minute antennae, large compound eyes, slender abdomen with posterior tracheal gills and a prehensile labium with dark brownish green back and pale abdomen. They are hemimetabolous insects which moult averagely fifteen times before it reaches adult stage. The final instar larva is about the size of 21mm in total length. The previous larval instar to the final instar (penultimate larva) and the one with one moult younger (antepenultimate) to the penultimate, having 16mm and 12mm in total length respectively.

### Determination of total proteins

The total proteins in the tissues (muscle, gut and rectal gills) of antepenultimate, penultimate and final instar larvae were determined by following the method given by Gornal *et al.* (1949). Muscle, gut and rectal gills (100mg) were weighed and homogenized with distilled water. The haemolymph (0.05ml) was centrifuged (2500 rpm) for 20 minutes. The homogenates and supernatant were used for analyses. To 0.05ml of each tissue homogenate, 10 ml of 80% ethanol was added and centrifuged for 15 minutes at 5000 rpm. To 2ml of each supernatant, 3ml of Biuret reagent was mixed. The mixture was kept in a water bath at 37°C for 10 minutes and then cooled. The optical density (OD) of the sample was recorded at 540 nm. A protein standard curve was prepared and referred to the analysis.

## III. RESULTS AND DISCUSSION

Physico-chemical characteristics of textile effluents of different stations (ST1 to ST6) are given in the Table 1. The parameters of the textile dyeing effluents show a drastic deviation from the standards prescribed by the World Health Organization (WHO) and Bureau of Indian Standards (BIS). In the present investigation, the effluent samples released from different stations displayed different colours such as grey, brown, red and blue with an offensive odour. The colour of the effluent might be due to the presence of biodegradable and nonbiodegradable high-molecular weight organic compounds and high amount of chemicals used during the processing. The textile waste water is highly coloured showing the presence of high concentrations of unused dyes. The different stations of the textile dyeing the odour may be due to the various chemical processing of textile dyeing effluents (Ravibabuet *et al.*, 2007). The offensive odour could be due to the presence of volatile compounds (Ogunlaja and Aemere, 2009; Arul *et al.*, 2011). From the results higher pH of all the effluents indicates that the effluents were highly alkaline due to the presence of various colouring agents (Senthilkumaret *et al.*, 2016). The increased EC of all the stations were observed, mainly due to the excessive usage of sodium chloride (Venkateshet *et al.*, 2009; Sathiyarajet *et al.*, 2017).

High levels of BOD and COD were noticed in all effluent samples. The high BOD may deplete dissolved oxygen, causing death of aerobic organisms and increase anaerobic properties of water (Jody and Dons, 2003). A high level of COD implies toxic conditions and the presence of biologically

resistant organic substances in textile dyeing effluents. It determines the oxygen required for the chemical oxidation of organic matter and assesses the quantity of chemically oxidizing matter in water (Vigneshpriya, 2015). The observed TDS and TSS values were higher than the level prescribed by WHO and BIS. This may be due to the presence high level of heavy metals (Yusuff and Sonebare, 2004).

Total nitrogen and total phosphorus levels were quite high in the effluent of all the stations because of the microbial action of the nitrogen fixing microflora and phosphobacteria (Moorthi and Nagarajan, 2011). Chloride and sodium were also found high in the effluent may be on account of water softening processes. The high concentration of sulfate is evident in the untreated effluent as a result of using sulfuric acid in various steps of dyeing and printing process. The high levels of calcium and magnesium were witnessed. Calcium hydroxide and magnesium salts were used to increase the alkalinity to enhance the dyeing processes which increase the hardness of the effluents and soil salinity at the end (Hussain and Hussain, 2012). The heavy metals such as cadmium, lead, copper, zinc and chromium in the effluents were estimated higher than the standard level. This may be due to the application of some dye stuffs which have metallic compounds (Correia, 1998; Vigneshpriya, 2015).

The present study also investigated all these physico-chemical alterations in the effluent that influenced the protein metabolism of antepenultimate, penultimate and final larval instar of dragonfly *B.geminata*. From the results, it is inferred that the textile dyeing effluents of all the stations have a negative effect on the protein levels of the test animals. The level of total proteins in the muscles of the antepenultimate larvae exposed to the textile dyeing effluents decreased significantly ( $p < 0.05$ ) in the larvae of ST5 at 3.5% (Table 2) as well as the least impact was observed in the dyeing effluent of ST2. The same trend was noticed in the penultimate and final instar larvae (Table 3 and 4).

The changes in biochemical parameters such as carbohydrates, proteins and lipids are important to indicate the susceptibility of organ systems to pollutants by altering their functions. Proteins are important organic substances required by organisms in tissue building and play an important role in energy metabolism (Remia, 2008). The protein metabolism of the larvae includes protein synthesis, degradation and growth. From the above observations, it is well clear that the protein metabolism is disturbed due to the pollutants present in the textile dyeing effluents. Proteins can be expected to be involved in the compensatory mechanism of stressed organisms. Even the experimental animals were fed adequately the total protein levels show a decreasing trend in the effluents of all the stations. Sponza (2006) studied the toxicity of textile dyeing effluents using several toxicity tests and found that besides the dyes themselves, ions like  $\text{Cr}^{6+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Pb}^{2+}$  also contribute to toxicity of textile effluents. The results of the present study showed that when the three different larvae were exposed to different concentrations of different stations of textile dyeing effluents the muscle protein contents were found to have decreased when increasing the concentrations. The reduction of protein may be due to proteolysis and increased metabolism under toxicant stress. It was reported that reduction in protein contents could be due to utilizing protein to meet the energy demand when the experimental animals are under stress (Sandhya *et al.*, 2006, Gehan, 2012).

#### IV. CONCLUSION

The organic pollutants and metal pollutants may interfere with the cellular mechanism of the aquatic insects and cause a hitch in protein synthetic routines. This may be resulted in decreased protein content of the *Bradinopygageminata*. Besides the protein in tissues might have underwent hydrolysis and oxidation for the need of energy, due to the suppressed protein synthesis in cells under pollutant stress as suggested by the earlier investigators.

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**TABLE 1. PHYSICO-CHEMICAL PARAMETERS OF THE TEXTILE DYEING EFFLUENTS OF VARIOUS STATIONS**

Parameters	Textile dyeing effluents in various stations						WHO/BIS
	ST1	ST2	ST3	ST4	ST5	ST6	
Colour	Grey	Brown	Red	Red	Blue	Blue	Colourless
Odour	Offensive	Offensive	Offensive	Offensive	Offensive	Offensive	Odourless
pH	8.34	8.78	7.95	8.81	9.28	9.36	6-9
EC (s/cm)	4.68	2.39	3.67	3.49	5.68	3.52	2-3
BOD (mg/l)	462	423	491	343	532	215	100

COD (mg/l)	2790	1281	3974	1698	3874	1221	250
TDS (mg/l)	8454	3321	3484	9985	10264	2517	1500
TSS (mg/l)	349	131	459	434	826	572	100
Total nitrogen (mg/l)	140	211	98	112	154	103	50
Total phosphorous (mg/l)	743	719	935	624	786	703	500
Cl <sup>-</sup> (mg/l)	1105	1384	1446	2140	1489	2648	1000
Na (mg/l)	1702	1657	1812	1926	2115	1623	10
SO <sub>4</sub> <sup>-2</sup> (mg/l)	1589	734	1496	613	1638	1845	1000
Ca (mg/l)	115	127	110	124	138	102	200
Mg (mg/l)	16	15	14	18	21	17	30-100
Cd (mg/l)	3.24	2.68	3.25	2.43	3.40	2.15	1.00
Pb (mg/l)	1.30	1.78	0.42	0.30	1.00	1.00	1.00
Cu (mg/l)	3.08	2.02	3.01	4.29	4.03	3.09	3.00
Zn (mg/l)	15	34	10	47	32	18	15
Cr (mg/l)	3.80	3.31	2.93	3.87	4.03	2.34	2.00

**TABLE 2. BIOCHEMICAL ESTIMATION OF TOTAL MUSCLE PROTEINS (mg/100g) IN ANTEPENULTIMATE LARVAL INSTAR OF DRAGONFLY *BRADINOPYGA GEMINATA* IN DIFFERENT CONCENTRATIONS OF TEXTILE EFFLUENTS TO 15 DAYS OF EXPOSURE**

S. No.	Stations	Concentrations of the textile dyeing effluents (% is derived from the LC <sub>50/96</sub> hr value of the respective stations)							P value (<0.05)
		Control (0%)	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	
1	ST 1	10.41±0.12	09.37±0.12	09.54±0.18	09.49±0.18	07.30±0.12	07.45±0.34	07.31±0.42	0.000001*
2	ST 2	10.41±0.12	09.68±0.05	09.70±0.46	09.64±0.32	08.94±0.18	08.60±0.48	08.21±0.21	
3	ST 3	10.41±0.12	09.55±0.41	09.37±0.39	09.18±0.14	08.24±0.36	08.18±0.91	07.45±0.32	
4	ST 4	10.41±0.12	09.67±0.37	09.10±0.28	08.24±0.51	08.13±0.15	08.20±0.78	07.32±0.15	
5	ST 5	10.41±0.12	09.24±0.48	08.27±0.13	08.02±0.23	07.54±0.14	07.13±0.18	06.65±0.62	
6	ST 6	10.41±0.12	09.19±0.24	08.92±0.90	08.40±0.35	07.65±0.84	07.21±0.33	06.97±0.13	

Two-way ANOVA of total muscle proteins in antepenultimate larval instar

\* Significance (P< 0.05)

\*\* Insignificance (P>0.05)

**TABLE 3. BIOCHEMICAL ESTIMATION OF TOTAL MUSCLE PROTEINS (mg/100g) IN PENULTIMATE LARVAL INSTAR OF DRAGONFLY *BRADINOPYGA GEMINATA* IN DIFFERENT CONCENTRATIONS OF TEXTILE EFFLUENTS TO 15 DAYS OF EXPOSURE**

S. No.	Stations	Concentrations of the textile dyeing effluents (% is derived from the LC <sub>50/96</sub> hr value of the respective stations)							P value (<0.05)
		Control (0%)	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	
1	ST 1	13.54±0.34	13.10±0.74	12.57±0.54	12.10±0.14	11.23±0.41	10.69±0.62	10.27±0.88	0.000391*
2	ST 2	13.54±0.34	13.04±0.82	12.88±0.62	12.61±0.22	12.34±0.13	12.13±0.55	11.84±0.32	
3	ST 3	13.54±0.34	13.38±0.13	13.34±0.17	12.78±0.15	12.08±0.92	11.17±0.18	11.02±0.64	
4	ST 4	13.54±0.34	13.24±0.05	12.80±0.25	12.47±0.56	11.44±0.71	11.18±0.29	10.22±0.81	
5	ST 5	13.54±0.34	13.42±0.42	12.49±0.65	12.02±0.54	11.35±0.85	10.30±0.76	09.28±0.68	
6	ST 6	13.54±0.34	13.04±0.21	12.48±0.31	11.89±0.32	11.35±0.46	11.08±0.51	10.19±0.58	

Two-way ANOVA of total muscle proteins in penultimate larval instar

\* Significance (P< 0.05)

\*\* Insignificance (P>0.05)

**TABLE 4. BIOCHEMICAL ESTIMATION OF TOTAL MUSCLE PROTEINS (mg/100g) IN FINAL INSTAR LARVA OF DRAGONFLY *BRADINOPYGA GEMINATA* IN DIFFERENT CONCENTRATIONS OF TEXTILE EFFLUENTS TO 15 DAYS OF EXPOSURE**

S. No.	Stations	Concentrations of the textile dyeing effluents (% is derived from the LC <sub>50/96</sub> hr value of the respective stations)							P value (<0.05)
		Control (0%)	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	
1	ST 1	15.41±0.61	14.80±0.48	14.27±0.21	14.64±0.24	14.87±0.55	13.26±0.51	13.12±0.25	0.000377*
2	ST 2	15.41±0.61	14.89±0.24	14.31±0.58	13.47±0.61	14.78±0.41	14.41±0.33	13.41±0.45	
3	ST 3	15.41±0.61	14.84±0.81	14.24±0.62	13.04±0.88	13.45±0.82	13.14±0.42	12.69±0.41	
4	ST 4	15.41±0.61	14.57±0.38	12.64±0.35	13.54±0.65	13.00±0.64	13.21±0.56	12.28±0.39	
5	ST 5	15.41±0.61	14.46±0.92	13.58±0.64	12.34±0.35	11.28±0.72	10.61±0.15	10.11±0.44	
6	ST 6	15.41±0.61	15.40±0.34	15.14±0.49	14.89±0.51	14.65±0.28	13.84±0.28	10.78±0.71	

Two-way ANOVA of total muscle proteins in final larval instar

\* Significance (P< 0.05)

\*\* Insignificance (P>0.05)

# HYPERTENSION IN INDIA: AN INSIGHT INTO THE NFHS - 4 DATA

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**Abstract-** The prevalence of non-communicable diseases is reaching epidemic proportions both in developed and developing nations. Non-communicable diseases (NCDs) kill 40 million people each year, equivalent to 70% of all deaths globally. The National Family Health Survey is a large –scale, multi –round survey conducted in a representative sample of households throughout India. For the very first time NFHS in its fourth series expanded the domain of clinical, anthropometric and biochemical testing (CAB) and included blood glucose and hypertension measurements. According to the NFHS 4-National fact sheet, the prevalence of hypertension is more widespread in men (13.6 %) than female (8.8%) population and also it is higher in case of urban subjects than the rural counterparts

**Index Terms-** Hypertension, India, NFHS 4, Prevalence

## I. INTRODUCTION

The prevalence of non-communicable diseases is reaching epidemic proportions both in developed and developing nations. Non-communicable diseases (NCDs) kill 40 million people each year, equivalent to 70% of all deaths globally. These NCD's mainly manifest in the form of cardiovascular diseases, cancers, chronic respiratory diseases and diabetes<sup>1</sup>. Cardiovascular diseases (coronary heart disease, stroke, and hypertension) contribute to 45% of all NCD deaths followed by chronic respiratory disease (22 %), cancers (12 %) and diabetes (3%)<sup>2</sup>. Hypertension is a chronic condition of concern because of its role in the causation of coronary heart disease (CHD), stroke, and other vascular complications. It is the most common CVD disorder which poses a major public health challenge to a population undergoing socioeconomic evolution. It is one of the major risk factors for CVD mortality, accounting for 20-50% of all deaths<sup>3</sup>. Every fourth individual in India aged above 18 years has raised blood pressure and the prevalence has increased by 10% from 2010 to 2014<sup>2</sup>.

## II. METHODS

The present review is an attempt to pool the NFHS 4 data highlighting the prevalence of hypertension across India for both rural and urban population .NFHS 4 data (National and State fact sheets) have been referred to for the same to highlight the prevalence of the same across different states in India.

## III. RESULTS

NFHS Background:

The National Family Health Survey is a large -scale, multi-round survey conducted in a representative sample of households throughout India<sup>4</sup>. It is equivalent of demographic and health surveys done in many countries around the world<sup>5</sup>. The National Family Health Survey (NFHS) was initiated in India in the early 1990s with the first NFHS conducted in 1992-93. Since then, India has successfully completed NFHS-2 in 1998-99 and NFHS-3 in 2005-06. In 2014-2015, India implemented the fourth National Family Health Survey (NFHS-4). In addition to the 29 states, NFHS-4 included all six union territories for the first time and also provided estimates of most indicators at the district level for all 640 districts in the country as per the 2011 census<sup>6</sup>. For the very first time NFHS in its fourth series expanded the domain of clinical, anthropometric and biochemical testing (CAB) and included blood glucose and hypertension measurements<sup>7</sup>.

### NFHS 4 Findings for high blood pressure:

In NFHS-4, blood pressure measurements were taken to assess the prevalence of high blood pressure in the population, using The OMRON BP monitor. To measure the respondent's blood pressure, three blood pressure readings were obtained. Blood Pressure measurements were taken for women 15-49 years and men 15-54 years<sup>8</sup>.

NFHS 4<sup>8</sup> has categorized hypertension in three sub categories# i.e.

- **Slightly above normal** (Systolic 140-159 mm of Hg and/or Diastolic 90-99 mm of Hg) (%)

- **Moderately high** (Systolic 160-179 mm of Hg and/or Diastolic 100-109 mm of Hg) (%)
- **Very high** (Systolic  $\geq 180$  mm of Hg and/or Diastolic  $\geq 110$  mm of Hg) (%)

NFHS 4 data depicts the mean prevalence of blood pressure to be 22.4% (for both men and women, total of all the three categories<sup>#</sup>). Table 1 represents the prevalence of hypertension in India in both rural and urban population. Prevalence is much higher in case of males in total and also across all the three categories in comparison to the female counterparts. Maximum numbers of respondents lie in the first category, i.e. slightly above normal (Systolic 140-159 mm of Hg and/or Diastolic 90-99 mm of Hg) which is 6.7 % in case of women and 10.4% for men.

**Table 1: Prevalence of Hypertension in India (Source: NFHS 4-India Fact Sheet<sup>8</sup>)**

	Slightly above normal (Systolic 140-159 mm of Hg and/or Diastolic 90-99 mm of Hg) (%)						Moderately high (Systolic 160-179 mm of Hg and/or Diastolic 100-109 mm of Hg) (%)						Very high (Systolic $\geq 180$ mm of Hg and/or Diastolic $\geq 110$ mm of Hg) (%)					
	WOMEN			MEN			WOMEN			MEN			WOMEN			MEN		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
<b>INDIA</b>	7.3	6.5	6.7	11.4	9.8	10.4	1.6	1.3	1.4	2.7	2	2.3	0.7	0.7	0.7	1.0	0.8	0.9

State –wise mean prevalence (Table 2) shows a wide variance in the prevalence of high blood pressure across different states/UTs. The highest prevalence was seen in Sikkim (43.8%) and lowest in NCT –Delhi i.e. 11.8% for both urban and rural populations and both the genders (men and women).

**Table 2: Prevalence of hypertension for all the Indian states and union territories (source-NFHS 4<sup>8</sup>)**

S.No	State/UT	Slightly above normal (Systolic 140-159 mm of Hg and/or Diastolic 90-99 mm of Hg) (%)						Moderately high (Systolic 160-179 mm of Hg and/or Diastolic 100-109 mm of Hg) (%)						Very high (Systolic ≥180 mm of Hg and/or Diastolic ≥110 mm of Hg) (%)					
		WOMEN			MEN			WOMEN			MEN			WOMEN			MEN		
		Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
1	ANDAMAN & NICOBAR	6.6	7.5	7.1	16.1	24.1	20.9	1.5	1.1	1.3	3.2	3.3	3.3	0.7	0.6	0.6	5.1	2.8	3.7
2	ANDHARA PRADESH	8.5	7.3	7.6	11.1	11	11	2.1	1.5	1.7	3	3.9	3.6	0.8	0.7	0.7	2	1.4	1.6
3	ARUNACHAL PRADESH	9.6	10.7	10.4	12.8	16.6	15.5	3	2.7	2.8	5	3.5	3.9	2.3	1.6	1.8	2.1	2.3	2.2
4	ASSAM	13.2	11.4	11.7	18.1	14.4	15	2.6	3.1	3	5	2.7	3.1	1.6	1.3	1.3	1.3	1.6	1.5
5	BIHAR	4.2	4.5	4.4	10.3	7	7.6	0.8	0.9	0.9	1.7	1.2	1.3	0.6	0.6	0.6	0.6	0.5	0.5
6	CHANDIGARH			7.4			0.6			1.5			2.9			0.4			0
7	CHATTISGARH	6.5	6.9	6.8	11.5	8.8	9.5	1.4	1.3	1.3	4.6	1.6	2.3	0.6	0.8	0.7	2.1	0.5	0.9
8	DADAR & NAGAR HAVELI	6.4	5	5.6	14.7	4.5	9.8	2.5	0.2	1.2	2.3	1.1	1.7	1.1	0.2	0.6	0	1.2	0.6
9	DAMAN & DIU	4.8	5.9	5.1	6.8	5.3	6.5	1.8	1.5	1.7	0.1	2.4	0.6	0.5	0.7	0.6	0.6	0.2	0.5
10	GOA	6.7	5.6	6.3	8.4	14	10.5	1.4	1.7	1.5	2.8	2.6	2.7	0.8	0.6	0.7	0	0.1	0
11	GUJARAT	8.2	6.7	7.4	10.8	9.2	9.9	1.7	1.3	1.5	2	2.5	2.3	0.7	0.8	0.8	0.6	0.9	0.8
12	HARYANA	8.2	7.2	7.6	14.7	14.2	14.4	1.5	0.8	1.1	1.7	1.8	1.8	0.6	0.5	0.5	0.5	0.7	0.6
13	HIMACHAL PRADESH	10.4	9.3	9.4	15.2	17.3	17	2.2	1.7	1.8	2.2	4.2	3.8	0.9	0.9	0.9	1.3	1	1.1
14	JAMMU & KASHMIR	11.1	8	8.9	12.6	10	10.9	1.7	1.9	1.8	1.5	1.8	1.7	6	1	0.9	1.4	0.9	1.1
15	JHARKHAND	6.5	5.6	5.9	10.6	8.7	9.3	1.3	1.2	1.2	2.5	1.8	2	0.6	0.8	0.7	1	0.9	0.9
16	KARNATAKA	7.0	7.1	7.1	12.5	11.7	12	2.1	1.8	1.9	2.4	2	2.2	0.6	0.8	0.7	1.4	1	1.2
17	KERALA	4.8	6.1	5.5	5.6	9.3	7.5	0.6	1	0.8	1.5	1.2	1.3	0.6	0.5	0.5	0.5	0.8	0.7
18	LAKSHWDEEP	6.9	14.6	7.4	9.1	11.1	9.1	2.9	0.4	2.7	0	0	0	0.9	0.3	0.8	0.8	0	0.8
19	MADHYA PRADESH	6.5	5.9	6.1	10.2	7.3	8.2	1.4	1.1	1.2	2.5	1.8	2	0.7	0.6	0.6	1.2	0.5	0.7
20	MAHARASHTRA	7.6	6.6	7.1	12.1	11	11.5	1.4	1.4	1.4	4.4	2.7	3.6	0.5	0.7	0.6	0.8	0.8	0.8
21	MANIPUR	9.3	7.9	8.5	18.9	14.1	16	2.1	1.8	1.9	4.4	2.3	3.1	1.2	0.8	1	0.7	1.7	1.3
22	MEGHALAYA	6.5	7.4	7.2	13.4	6.4	7.9	1.9	1.9	1.9	1.6	1.4	1.5	0.8	0.8	0.8	0.9	1	1
23	MIZORAM	8.1	6.4	7.4	14.3	10.5	12.8	2	1.5	1.8	5.7	2.6	4.5	0.5	0.8	0.6	0.6	0.6	0.6
24	NAGALAND	11.4	9.8	10.5	21	13.9	16.7	3.7	3	3.3	6.9	3.9	5.1	2.4	2.1	2.2	2.2	0.8	1.3
25	NCT DELHI	5.9	0.2	5.9	3.8		3.7	1	0	1	0.4		0.4	0.7	0	0.7	0.1		0.1
26	ODISHA	7.8	6.7	6.9	13.1	8.8	9.7	1.8	1.3	1.4	3.7	1.5	2	0.6	0.7	0.7	0.9	0.7	0.8
27	PUDUCHERRY	7.2	5.9	6.8	14.2	6.2	11.5	2	0.5	1.6	0.8	5.4	2.4	0.9	0.4	0.7	1.3	1.2	1.2
28	PUNJAB	9.7	11.1	10.5	15.2	18.9	17.4	1.8	2.1	2	3.1	3	3.1	0.5	0.8	0.7	1.5	1.3	1.3
29	RAJASTHAN	6.4	5.2	5.5	11.6	9.7	10.2	1.5	0.7	0.9	2	1.6	1.7	0.6	0.5	0.5	0.8	0.4	0.5
30	SIKKIM	13.1	11.1	11.7	17.7	21.1	19.6	3.5	2.9	3.1	7.2	2.8	4.7	1.9	1.6	1.7	4.6	1.7	3
31	TAMIL NADU	6.8	5.3	6.2	12.2	10.8	11.5	1.9	1.2	1.6	3	2.5	2.8	0.6	0.5	0.5	1.2	1.2	1.2
32	TELANGANA	8.1	6.8	7.4	14	10.6	12.2	1.8	1.6	1.7	3.6	3	3.3	1	1.1	1	3.4	2.2	2.7
33	TRIPURA	11.5	8.9	9.7	8.5	13.4	11.9	2	1.7	1.8	2.2	1.2	1.5	0.8	1.3	1.1	0	0.2	0.2
34	UTTAR PRADESH	6.4	5.8	5.9	10	7.5	8.2	1.3	1	1.1	1.9	1.2	1.4	0.7	0.6	0.6	0.6	0.4	0.5
35	UTTARAKHAND	8.1	6.7	7.2	14.8	12	13.1	1.9	1.4	1.6	4.3	2.6	3.3	1.1	0.7	0.8	0.9	0.8	0.8
36	WEST BENGAL	9.1	7.2	7.8	12.2	8.8	9.9	2.1	1.7	1.8	2.3	1.4	1.7	0.8	0.7	0.7	1	0.7	0.8

■ Top five highest prevalence rates (Men & Women)

■ Bottom five lowest prevalence rates (Men & Women)

Further analysis of the survey highlights that the top five states with highest prevalence<sup>ε</sup> are Sikkim (43.8%), Nagaland (39.1%) Andaman & Nicobar (36.9%) followed by Arunachal Pradesh 36.6% and Assam (35.6%). There are inter and intra disparities in prevalence rates that differ in case of men and women. Table 3 highlights the data for the same. For men, highest prevalence is 27.9% (in Andaman & Nicobar Island) while lowest (3.5%) is seen in Chandigarh. For women the highest and the lowest prevalence rate is 16.5% and 5.9% in Sikkim and Bihar respectively.

**Table 3: Top 5 states reporting highest prevalence of hypertension in Men and Women (NFHS 4)**

S.No	Men <sup>ε</sup>		Women <sup>ε</sup>	
	State/UT	%	State/UT	%
1	Andaman & Nicobar Island	27.9	Sikkim	16.5
2	Sikkim	27.3	Assam	16
3	Nagaland	23.1	Nagaland	16
4	Himachal Pradesh	21.9	Arunachal Pradesh	15
5	Punjab	21.8	Punjab	13.2

<sup>ε</sup>depicts average of rural and urban population and sum of all the three categories of high blood pressure as classified by NFHS 4)

NFHS provides extensive data on the demographic and health indicators which is further used as reference standard by many national and/or international organizations, policy makers and also provides the wider picture of the health worldwide. NFHS 4 has provided data related to prevalence of high blood pressure across different states /UTs for rural and urban population, separately for men and women. However, it is noticed that there are some limitations related to the same as there is no information provided in the survey so as to show that out of the total respondents assessed for blood pressure how many were already known cases of hypertension (hypertensives) or whether or not they were on the hypotensive drugs or medications. It is also a possibility that for some respondent's hypertension may be present as a primary/ secondary health complication along with other chronic diseases like diabetes; cardiovascular disorders etc. and they might be on some medications that may have a lowering affect on blood pressure levels thus leading to an underestimation of the present scenario. This is evident in the prevalence rates as reported in the present survey for states like Delhi, Chandigarh, Bihar, Uttar Pradesh and Rajasthan highlighting the prevalence to be much lower than what is documented in other research studies.

#### IV. CONCLUSION

Hypertension is one of the most important underlying and overlooked cause of developing cardiovascular disease. In many cases if untreated or uncontrolled may lead to serious health implications. It is important to address to the present scenario of its increasing prevalence not only in India but also globally. Timely screening and adequate medical and dietary interventions will not only help to reduce its prevalence but also reduce the risk of developing related health implications.

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# Suraki Bhoomi: Landslide Early Warning System

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## Abstract

During past few years there were several types of Landslides Early Warning Systems developed in the world wide. Mainly Asian countries which effect by south-west and north-east monsoon rainfall are mindfulness for this objective. Due to weather changes landslides become more frequent and cause damage to people. In this situation people need complete landslide early warning system to protect their resources. The implemented system is capable of predicting a possible landslide in a given area and issuing warnings that would assist in risk management. This research project has a low-cost, sustainable early warning system to send warning alerts via Short Message Service (SMS) to monitor the landslides. The system uses data mining to identify what are the most dangerous areas for landslide. After that, the sensors are placed in the areas to detect landslides. System calculate values what are the probability for a landslide to happen be high. Then the system will generate a warning Alarm and warning message and it will send to people with using Siren and SMS or Android application. System administrator can handle this system using his Desktop application.

*Keywords: Detect landslides, Warning System, SMS, Alarm, Android Application, Data Mining, Desktop Application, Siren, GSM*

## I. INTRODUCTION

“Suraki Bhoomi” Landslides Early Warning System which specify to the landslides areas. This is a warning system to alert the people in dangerous areas for landslide. The research team decided to add datamining system for identify landslide areas with using clustering method. Devices are placed at the risk area to get data to the system. System is very small and very light. Then it can be placed on anywhere any time and easy to move. This system has many components such as sensors, alarms, data mining system, android application, server, desktop application, SMS system. It can calculate the distance about earth crack and ground water level with using several types of sensors.

Send an alarm to the nearest area, send a SMS notification, android application identify landslide areas and online data can send to nearest server. National Building Research Organization in Sri Lanka is our main resources holder. Initially a data-mining model used for get well prediction to searching most dangerous areas for landslide. Sensors are set in those areas. Module is based on several types of sensors using Arduino, GSM module. It is measured by getting a movement of ground displacement and ground water level.

Process of the ground water level sensor is soil moisture sensor calculates the water volume of a measured soil sample. Rain sensor calculates the water volume of a measured rain water sample and the value is display using a screen. If the water level is higher than the level in the module it is too dangerous, then system will indicate an alarm.

Data which were gathered out of Arduino sensor calculations are being transferred to the online database through the GSM module. Simultaneously data gathered and transferred to the database as warning alerts.

At the Earth displacement sensor, Earth displacement measured by moving two point of ground. This is calculate with using couple of Arduino sensors. When the ground is displacement sensors move a side. Module calculate the

distance and the crack is too dangerous system will indicate an alarm.

In this manner the attainment data with using displacement sensors, to send the database through the GSM module like risk warning. Both two sensors can directly send SMS to users.

The SMS notification system notifies the warning message to the people in near area can attention about the alert and they can go to the safe area. SMS notification system is a useful method.

Warning system store data about landslides. Data can be send to a nearest server via GSM module.

The desktop application for system administrator named as “Suraki Bhoomi”. Administrator handle the system data without came to the module and getting data. System administrator directly add rainfall data to server using desktop application which gathered from National Building Research Organization as CSV file format. Administrator add the geological details to server and view the details using pie charts and bar charts. Administrator can view the detail where coming from couple of sensors. System send the emails who staff members and peoples where in dangerous areas.

Landslides detecting is very important for the people. “Suraki Bhoomi” android application includes data of landslides area. This application includes three-year data of landslides. Landslide area are mapping online and update 04 months. In the map dangers areas are represented using different colors. It will help people to recognize the places of landslides.

## II. LITRETURE REVIEW

“Suraki Bhoomi” Landslides Early Warning System research team studied numerous published research papers, articles and documents from various sources. National Building of Research Organization is the main resource center where the research group collect that information. Using that knowledge

above mentioned sources it assistance the research group to develop a unique and well-informed system.

“AsaniWasi” is a landslide early warning system, in this system the focus is on measuring of distance between two points of the slope and the ground water level [1]. Sensors are placed in the risk area to get data to the system. Critical limitations of the factors for landslides to occur are stored in the system. When the system detects that it is exceeding the limits, warning messages are automatically sent to the relevant people via SMS. However, “AsaniWasi” have an issue, in this research project have not use any Data mining system. “SurakiBhoomi” will allow using Data mining.

“Landslide Early Warning System for Rural Community as an Application of Sensor Asia” is an early warning system for landslides was developed and deployed in Banjarnegara Region of Indonesia as a part of Asian Joint Research Project and Sensor Asia Initiative [2]. A Field Server was used to collect data from several sensors and display them in a web page in real time. Other advantage is, a graphical interface is also provided at the local site for community people to see the movement and the warning level. There are some disadvantages in this project, the system used only Linux system to store data and have not SMS. “SurakiBhoomi” will allow to use any operating system platforms and send messages with using via SMS.

“Development of Landslide Early Warning System Using Macro-Bending Loss Based Optical Fiber Sensor” [3]. This research using fiber optic sensors were made by wrapping a polymer optical fiber. Through the research paper mainly consists of a displacement fiber sensor, mechanical displacement converter, and Short Messaging Service (SMS) gateway equipped with a siren. Research did not develop data mining part to detect landslide areas.

“Design and implementation of a landslide early warning system” was down by Emanuele interior, Giovanni Gigli, Francesco Mugnai, Riccardo Fanti, and Nicola Casagli [4]. It is the early warning system for the rock slide including the geological knowledge, the risk scenarios, kinematic characterization of the landslide, the choice and installation of the monitoring system, the setting of appropriate alarm levels and the definition of plans of civil protection. It did not provide ground displacement detecting sensor or SMS.

“Automated Statistical Data Mining of a Real World Landslide Detection System” is presents an architecture which have developed for automatic data mining of landslide data which will ultimately help in issuing an early warning for occurrence of landslides [5]. This work has been partially funded by "Monitoring and Detection of Rainfall Induced Landslide using an Integrated Wireless Network System" project funded by Department of Science and Technology (DST), India and also by "Advanced Integrated Wireless Sensor Networks for Real-time Monitoring and Detection of Disasters" project funded by Ministry of Earth Science, Government of India.

Y.Srinivas, K. Raghava Rao indicated “Landslide Warning System Using Zigbee. And Global Positioning System (GPS) is design combines of GSM wireless communication

technology and Wireless Sensor Network” [6]. This research implements SMS and landslide monitoring system. Zigbee used three sensors of Angle sensor which gives the readings of slope angle if there is any movement in landslide and we have Liquid level sensor it collects the depth of water at the mountains. Temperature sensor gives the changes in the temperature. SurakiBhoomi” will allow to use several sensors to detecting ground displacement and warning alerts.

“GSM Based Real-Time Wireless Sensor Network for Landslide Detection” is a one of system with using Wireless Sensor Network (WSN) and Global System for Mobile Communication (GSM) to a remote data center [7]. System monitors the changing geo-technical condition using various geo-technical sensors. This system has not contained any ground displacement detecting sensor or warning alarm. “SurakiBhoomi” will allow to use several sensors to detecting ground displacement and warning alerts.

### III. METHODOLOGY

This project used the prototype methodology because the target was the end user’s satisfaction, which was accomplished in a lot of implementations of updated versions of the previous systems that were created. By prototype methodology developers show the user phase by phase their system development.

#### A. Planning

Main issues that came into consideration were financial problems, Database issues, Interface integration issues and Time management.

After a thorough look a final conclusion took place about the above mentioned economical and technical problems. To ensure that the project goes smoothly, techniques such as a Gantt chart and a work Break Down structure has been used to ease out the workload so that the application manages time, resources (Human Resources, Hardware etc.) and have a smoother control over the project.

#### B. Requirement Gathering and Analysis

Information and data required to the new system has been gathered through techniques such as research papers, interviews with visitors, questionnaires, analyzing reports and by conducting meetings with supervisors etc. The Documents related to research was collected and has been evaluated thoroughly. Questioning people on different levels who are currently involved with the system helped in finding requirements to build the new system. Simple questionnaire has been given out to visitors from different areas to obtain visitors opinions from them.

Finally, analyzing took place only after getting enough prospective on the problem thoroughly before the design

phase. The team was able to recognize user expectations in this phase.

Circuit diagram of ground Displacement sensor describe how to calculate displacement of the crack.

C. Design

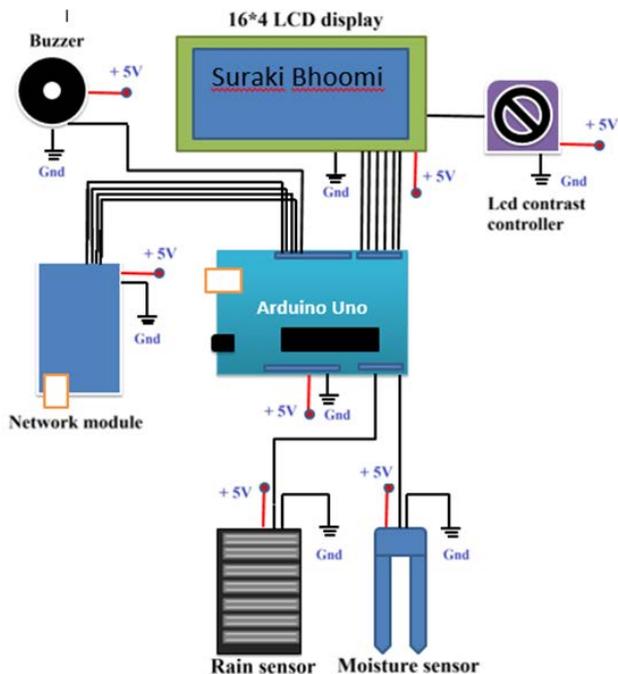


Fig.1. illustrates the circuit diagram of ground water level detecting sensor.

Circuit diagram of ground water level detecting sensor as Fig.1 point out how to append couple of sensors, GSM module and Buzzer.

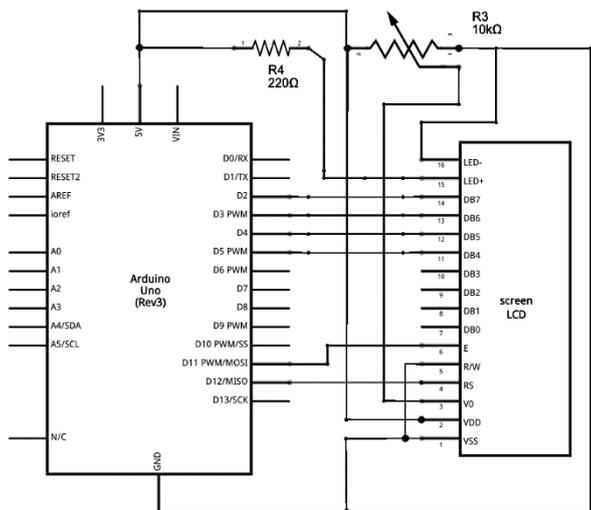


Fig.2. illustrates the circuit diagram of ground Displacement sensor.

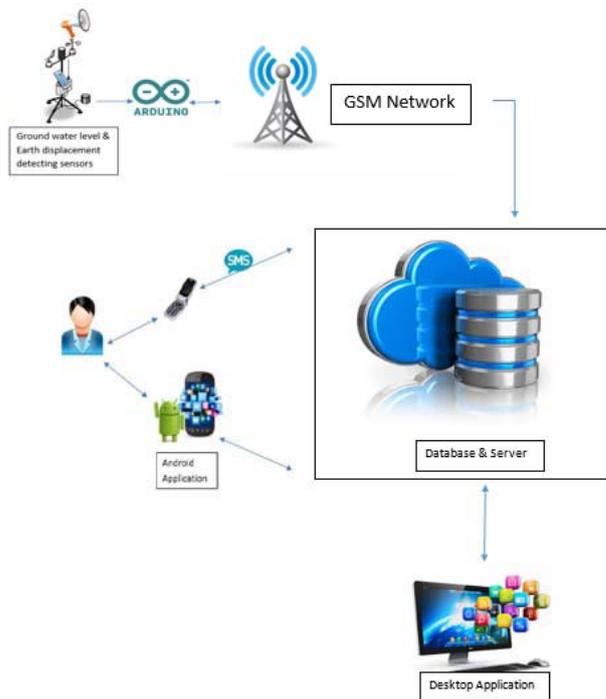


Fig.3. High-level Diagram

Architecture Design as Fig.3 is describe what are the main components and flow of the system.

D. Implementation

Since the system has five main components, Data Mining, Sensors, Server, Android application and the Desktop Application, for implementation of the system has wanted different platforms. Android studio will be used to develop the application with the aid of XML, JAVA and other android related languages and equipment. Data Mining system developed based on MS SQL and MS business intelligent R2 Version.

NetBeans will be used to develop the Desktop application with JAVA. Sensors are developed by using Arduino. Server will be developed based on languages that fulfill the requirements of the server that system wanted and it will be easy to make changes if there are problems on implementing the system because of using prototype model.

After completed the implementation of the system the data comes to server from sensors with using GSM module. Desktop application and android application are connected to the server using web services. Local host will be use to testing process.

Web server and the android application, both of systems need to be installed on relevant devices like the android application need to be installed on an android smart device and the web server need to be hosted in a public server.

*E. Testing*

Integration of the modules and testing are done in this phase. This must be done in a well-planned manner in order to inter-relate each module correctly. The system testing part of a testing methodology involves examining the entire system for errors and bugs. This test is carried out by checking the hardware and software components of the entire system (that have been previously unit tested and integration tested), and then testing it as a whole. Load testing was also used. Security was tested after the implementation. Applications, which connect to the servers, can be faced on Cyber-crimes and irregularities. Some security measure need to designed and developed at the same time as the desired business functionality. Security testing has inspected the software for integrity, confidentiality, availability, non-repudiation and authentication. Individual tests have been conducted to prevent any unauthorized access to the software code.

**IV. RESULT AND DISCUSSIONS**

This chapter covers the results that were achieved from the research project and what were the new approaches found to address further research in the undergraduate context.

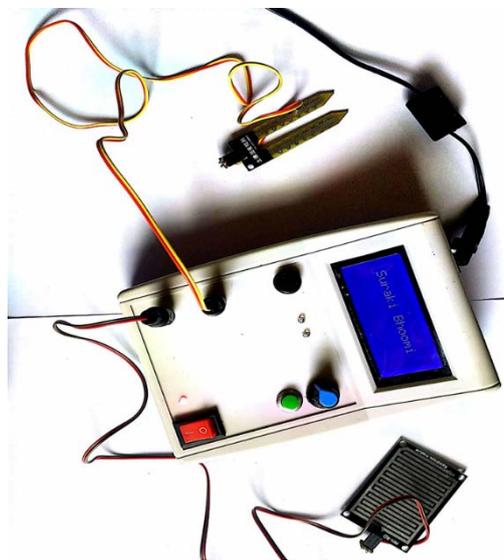


Fig. 4. Ground water level sensor

This is the ground water level detecting sensor as Fig. 4. This has two sensors, soil moisture sensor and rain sensor. Sensor values are displayed as a percentage value in a display. This

value can pass to the server via GSM module. If the value is shown in the display is high the buzzer will activate and sound an alarm.

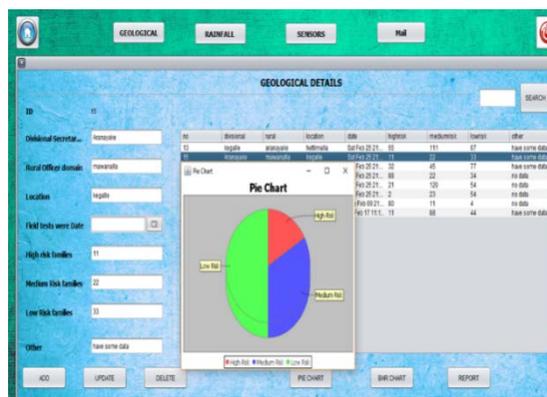


Fig.5. Geological data

Admin can input hard copy of NBRO geological data to the system as Fig.5.

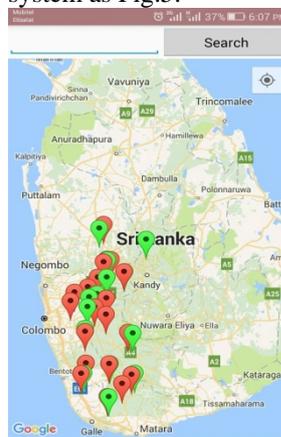


Fig.6. Map Page

In Map page, user can use search the place that landslides were happened and also navigate to current location where the user is in.

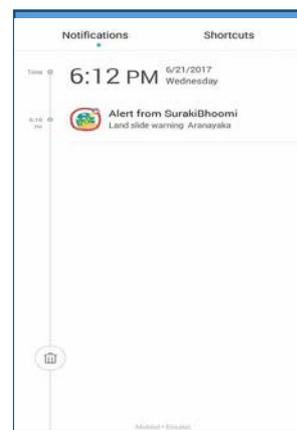


Fig.7.Alert

Alert message will receive to the user when user is in online as Fig.7. The message will be receiving from the database server.

our works. It is with great pleasure that we express deep sense of gratitude and profound feeling of admiration to our project lecturer in charge Mrs.Gayana Fernando for instructing and advising through the entire project plan.

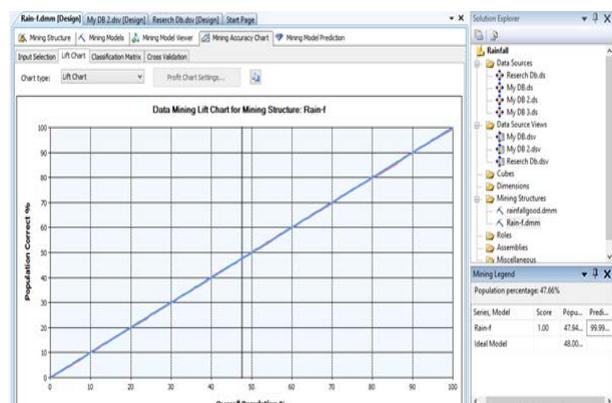


Fig.8.Mining Structure

Data mining list chart for mining structure using rainfall details as Fig.8. After referring quite a few methodologies of data mining predictions the research team could identify the most effected months for landslides. According to rainfall data in Kegalle region period from March to May is the most dangerous months for landslides.

#### V. FUTURE WORKS AND CONCLUSION

Implemented system presented an efficient and affordable method for real time problem solve system. The method consisted of two categorize the problem and give the best solution for the problem.

There is a limitation to be highlighted in “Suraki Bhoomi” system. In order to use this system research group, have not enough data to data mining to get good prediction. Though the data for data mining is a limitation.

Recommendation to those who willing to develop this system further as follows;

- System can setup all over the Sri Lanka where landslides will happen.
- Add more data and do the data mining to get good result.
- Develop the system to get more accurate result.

As the research was limited to a specific area focus on Kegalle District Aranayake area. In the future the group is willing to do more data mining and setup the system where the landslide happens other districts in Sri Lanka.

#### VI. ACKNOWLEDGEMENT

First and foremost we would like to thank Mr.Dhishan Dhammearatchi our project supervisor for guiding motivating

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# E – Voting Election Implementation In State Law

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**Abstract** - Electronic voting is seen as a tool to make the electoral process more efficient and to increase confidence in the organizers. Indonesia country that adopts democracy is required to hold elections free and fair and meet the principles of direct, general, free and secret. E-Voting information promised election results can be obtained quickly and real-time through the use of ICT in the delivery process and the vote count. Need for a strong national legal foundation for the implementation of E - Voting.

**Index Terms** : General Election, E – Voting, State Law

## 1. Introduction

The development of science and technology or known by today's science and technology coupled with the development of society and the international community, or more popularly, the term globalization has undoubtedly brought a very significant impact on the development of all countries in the world.

The impact in this case can certainly be a positive impact that will help human life and negatively highly detrimental to humans [Nuansa Aulia, Bandung, 2013].

Later Today more and more people are beginning to understand and make advantage to what is called information technology. Along with the progress of information technology has changed human life becomes easier because technology is always spoil a man with all its sophistication. Humans who have been in the running activities manually using human power now has turned to the use of technology.

Developments in information technology enters a new way of life known e-life, which is defined as the lives that have been affected by a variety of media-based electronics such as e-commerce, e-government, e-banking, e-library, e-education, etc. , The work completed with the use of this technology will be

easier because it uses new and advanced media and high-tech. This technological advancement contains a lot of positive value to the user community due to the presence of information technology makes all the work to become more effective and efficient.

Improved information technology gave birth to the Internet as a phenomenon in human life that provide tremendous benefits for business development, exchange of information, science and technology.

Various information can be presented with the sophisticated and accessible both in terms of distance or close by using telecommunication technologies associated with computer media as a supporting device and the Internet as the core device. People assume that this world has no limits. So great and rapid development of this [Nilma Suryani, 2013].

The haste in issuing policies that affect the lives of many people, or more precisely Indonesian people, is the practice of decision-making frivolous.

Including haste in determining whether the nation would use a system of electronic voting (e-voting) in the Regional Head Election. In a democratic country and representatives of presidential elections is usually done by voting. Voting here is how to make choices by punching or check list choice.

Voting usually used in determining divulging options to get the results of an election process.

In the exercise of voting, will be full of fraud. Fraud usually occurs in the counting process (inflation outcome of the vote). With frequent problem in the use of voting in the election process to make people's lack of confidence in the results of voting, both in the general election and the local elections.

Along with current technological developments, voting can be done electronically. Voting is done by the so-called information technology with electronic voting (e-voting).

Implementation of e-Voting is expected to overcome the problems that occur when using conventional systems (voting). In addition to overcoming the problems in the election, e-Voting is also able to save on the cost of implementation. In the use of e-Voting is no longer using ballots. The means used in the process of e-Voting is clicking or touching the screen (touch screen) to determine option [Made Leita Anistiawati, 2015].

A step forward has been taken by the Constitutional Court (MK) related to methods of regional head elections in Indonesia. The Court recently decided when the method of e-voting or touch screen can be implemented in the election-election in Indonesia. The Constitutional Assembly declared that Article 88 of Law No. 32 Year 2004 on Regional Government, constitutional conditional. That article actually states the election is done by voting. However, the Court found the meaning of 'voting' in this article is defined as of e-voting [http://www.hukum online.com].

This matter the government expressed his agreement if there are areas you want to use e-voting in election implementation, as long as the human resources and the community in the areas concerned are ready.

Implemented correctly, the e-voting can reduce some fraud plural occurs, accelerating the processing of the results, improve accessibility and make the election to be more convenient for the people-in some cases, when used in a series of elections, the possibility of reducing the cost of the election or referendum in the long term, If not planned and designed carefully, the introduction of e-voting could undermine confidence in the entire process of Election.

Therefore, it is important Application of E - Voting in elections to regional exist under national law in accordance with aspects E Voting implementation. The case studies similar to this case one of the forms of cybercrime is hacking (the perpetrators are called hackers). Hacking is the first form in this crime (first crime) as defined by the UN-X congress in Vienna in 2000. This is due to the form of this offense is something special, because it has the advantage of other forms of cybercrime.

Among them is that the perpetrators of these crimes are certainly able to do other cybercrime. Next technically the impact of hacking activity resulted in quality as a result of a more serious compared with other forms of cybercrime. To disseminate pornographic pictures or cyber pornography, people do not need the ability hacking, quite minimal internet capability [Agus Raharjo, *Op. Cit*, page 200.].

Actions of various elements contained in Article 167 paragraph (1) and (2) Criminal Code, raised a variety of questions if it is associated with the act of hacking. The question is; whether the computer system of a person or an organization, or a website in a computer network (the Internet) can be categorized as an object under Article 167 Penal Code? Cybercrime today can be prosecuted by the Criminal Law that regulated the Criminal Code.

## 2. Research Problem

Based on the background research problem is how does Application of E - Voting In Election In State Law By Law No. 8 of 2015 concerning local elections?

## 3. Research Strategy

The research approach is a method or way researchers conduct research in order to obtain information on the various aspects of the issue sought to find the answer according to the type of research that is juridical - normative, the authors use the approach Regulations - law (Statute Approach) in this study. As is the approach of law - law (Statute Approach) is a study of the product - the product legal. This approach is employed by the author in order to examine the law - laws pertaining to focus on the problems studied, at the same time see the consistency of law - law.

## 4. The Concept of E - Voting

- a. Internally, the electronic voting system has many functions, including encryption, randomization, communications, and security systems. Specific analysis on the functions is beyond the purpose of this sheet. For a basic understanding of the things that can be done by e-

voting systems, therefore, need to consider the following list of some of the functions that can be provided by the end of the system to voters and election officials.

- b. Electronic voter list and voter authentication. Part of the electronic voting system could be electronic voters list, include one polling station or across the country. This list can be used to authenticate the eligible voters and noted that they had voted
- c. Screen for election workers. The special function is only available for workers voting, for example, which is recalculating the sound at the opening of polling stations, the closure of the election, the printing and delivery of results
- d. Screen for a given sound. It includes a touch screen, optical markers recognition (OMR) ballots inserted in the scanner, touch-sensitive tablet, buttons, web pages or software specifically for election voters via the Internet
- e. Special screen for voters with disabilities. Including, Braille or audio input device for the hearing impaired, easier access for voters with disabilities, and the screen is much simpler for illiterate voters
- f. Screen for the election results. For voting machine (see definition below) is not rare form of the printing press. However, some machines use only the digital display. When the polls closed, the screen can be used to display or print the results recorded by the voting machines. If the result is printed, then the printed sheet can be used as physical evidence of the results generated by the voting machine and copies can be distributed to the stakeholders who were present at the polling stations and can also be mounted for display in public places public
- g. Printing machine to print a proof of the voter can be verified for each vote (see trace data document voter verifiable audit / VVPAT below)
- h. Results transmission system. Many voting machines that can transmit the results to the central counting system, for example via the Internet, telephone, cell phone or satellite connections. When there is no communication network,

the result can be sent physically, using electronic storage media such as memory cards

- i. System tabulation of results, generally located in the center of the processing results. At the end of election day, they receive the results electronically from polling stations and automatically tabulates the results for a variety of contestants and the electorate
- j. System publication of results. Results beginning and end can be publicized through various means, including web pages, CD and geographic visualization system, and if needed, at every level up to the polls. The more detailed the results were published, the more transparent election
- k. Confirmation code system. Some e-voting solutions allow the control code that is intended to allow the verification of individuals at each vote by the voter concerned [Caarls, Susanne, 2010].

## 5. Data Analysis And Finding

The Prepare or ensure the socio-political environment that supports an important factor for the success implementation of e-voting. Sometimes, the electoral system is poorly designed or is not appropriate, can be successfully used for some time if the environment is broadly supportive. However, when the fundamental technical problems grow big, sooner or later, that problem would complicate the process.

Therefore it is worth noting that confidence in e-voting system that deserve to be expected in the sense that the e-voting solution selected is built on a solid technical foundation. Some of the technical foundation has legal aspects, management of ICT projects, commercial aspects and time.

Referring to the case of the Jembrana test material to the Constitutional Court (MK). Testing refers to Law No. 32 of 2004 related holes and tick. Jembrana proposed to be use of information technology that is e-Voting. Submission of material testing it finally got the approval of the Constitutional Court (MK) provided that the application of e-Voting is based on the principles of direct, clean, honest and fair. Approval was also seen on the readiness of Jembrana regency will be five

components, namely the readiness of the technology, funding, organization, human resources and legality.

Filing judicial review conducted Jembrana actually done to organize the local elections. In this case, the decision of the Constitutional Court (MK) as a legal basis to conduct the local elections with no e-Voting. To carry out the local elections with e-Voting must be an underlying legislation. So that the local elections in Jembrana with e-Voting system cannot be realized.

The protocol of the e-voting system proposed should be published. The protocol determines how a system to communicate and exchange data in a digital format with other systems. Within the framework of e-voting, the protocol was based on a set of electoral rules, which are defined by a set of code of laws about elections, about how an election process should implemented, i.e. how voters should choose, how the votes were transferred to the ballot, how the voice data should be calculated and displayed, and others [Hapsara, M, 2011].

The protocol is built on the system design phase. Enforcing transparency through Security by Design in this case means that the protocol of the e-voting system proposed should be published to be observed and judged by the public.

PKPU constitution no. 8 Year 2015 concerning Election, Research and Development of the Ministry of Home Affairs (MOHA) is conducting a study of the implementation of e-voting and e-recapitulation for the elections and already propose a revision to the House. So for now the legal basis for the implementation of E Voting Act is not strong, because there is no legislation governing the guidelines E Voting in detail.

## 6. Conclusion

The implementation of e-voting in Indonesia have to go through a very deep study of various aspects. As was required by the Court that in implementing e-voting should qualify cumulative five principles that do not violate the election: the overflow and fair and should be ready in terms of technology, finance, human resources, software, and people. To further the Ensure the successful implementation of e-voting requirements of the Constitutional Court should be augmented with the principles that have been issued by international institutions for the

implementation of e-voting room fellow include eligibility and authentication, uniqueness, accuracy, integrity, supremacy and accountable , encryption, flexibility, cosy, verifiability, transparency, and cost-effectiveness. From a variety of Reviews These principles, the principle of cost-effectiveness should be a major concern if we want to realize democracy to the welfare of society

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# **An empirical study on rural women empowerment through self-help Groups and providing various earning opportunities in rural Villages in Prakasam District, Andhra Pradesh**

**Sk.Khadar Basha**

**Abstract:** Nowadays women play an important role in all sectors and influence economic, social and cultural opportunities. Women Empowerment is a multilevel development concept. Rural women empowerment means in all round development of rural women in socio and economical development of well being especially in education, income level and other factors. Women interactions, duties and responsibilities are increases in day by day in all sectors. The title of the study focused on rural women empowerment in rural areas for making or creating of self help groups and providing various earning opportunities in rural villages i.e. MGNREGS scheme, skill development programmes, livelihood programmes implemented in rural villages in prakasam dist, Andhra Pradesh state. The main objective of the study is empowerment of rural women through SHG's and earning opportunities in rural areas. We analyzed various data (web-based research) related to women empowerment in rural villages for doing this research study. Finally, we can understand how to empower rural women through self help groups and providing various earning opportunities in rural villages. The study concluded that it economically empowering women and give independence and self esteem. Therefore it might be caused for substantial development of rural women in living & economic conditions.

**Key words:** Rural women Empowerment, Self Help Groups, Earning opportunities in rural villages.

## **INTRODUCTION:**

Rural women empowerment means all round development of rural women in all sectors or fields especially in education, employment, socio and economic opportunities. The study improving women economically sound and strengthen women economic security. Our aim is to change woman individually as well as institutionally for all round development of women in all fields in socio & economic way. Our government of India implemented so many acts and schemes for women for securing of their rights. Most of the people live in rural villages; villages are back bone of the country. Without having the villages in the world we don't imagine the world. In rural villages so many community people are lives in for doing agricultural works. Agriculture is the most important source of rural people. But most of the rural women living in this situation, they don't have education knowledge, poverty, low income level, lack of other resources etc. Behind this reason the study focused on rural women empowerment in rural areas in prakasam district, Andhra Pradesh in such a way If we can provide and empower the rural women in all fields forexample (education, employment, economic conditions and other factors), they can develop all sectors then automatically we get economic development of the country. Women empowerment is an important criterion for the development of rural

villages. For achievement of rural women empowerment the study emphasized through creating various SHG's and providing various earning opportunities in rural villages in prakasam district, Andhra Pradesh.

### **BASIC NEEDS OF RURAL FAMILY:**

It is observed that average rural family faces following problems in their day to day life.

1. Availability of clean drinking water.



2. Clean and Healthy Toilet facility.



3. Assured supply of fuel for cooking.



4. Availability of Electricity.



5. Skill based education and entrepreneurship development:



### **RURAL WOMEN-EMPOWERMENT:**

Empowerment of rural women is a multi level development concept. Women's empowerment is a process in which women gain greater control over resources i.e. material, information, ideas and financial

resources, human and intellectual like knowledge, like money and control over decision-making in the home, society and community and nation, and to gain 'power'.

According to my opinion, women empowerment means all round development of rural women in all fields like education, money, status and employment opportunities, decision –making etc. One more definition of rural women empowerment means transfer from powerlessness women to one of power women in the society. Behind this reason I mean development of women, women can improve the following things:

- Learning of education and training programmes
- Learning of skill development programmes
- Learning and aware of the livelihood programmes and skills
- Support of the empowerment of others in the community
- Improvement of creative thinking power and decision making process etc.

### **OBJECTIVES:**

- To strengthen the economic development of rural women and create a conducive environment for social change.
- To create self confidence in rural women by providing and involving them in income generating activities.
- To provide opportunities to the members of the groups to ensure women's access to credit financing.

### **THE FOLLOWING POINTS ALSO CONSIDER FOR EMPOWERING OF WOMEN IN RURAL AREAS:**

#### **EDUCATION:**

Education is the most important weapon for development of the women in rural areas as well as society in the country. Women empower can be defined, "One family, One woman, One community and it may be causes for towards development of the villages and the nation. So totally I told that one woman education will be changed entire family, society, community and world also. Even though education can increase the women status within the family as well as outside world. Our government of India has taken precautions gender bias in the universities, colleges and schools. That is the reason our government of India eliminates the variations related to gender or sex (male, female) in the country. Behind that reason our government established co-education universities, colleges, schools as well as separate women institutions also. Most important thing is our government of India has been providing packages of concessions in the form of free supply of books, mid day meals, scholarships, free by cycle and so on.

As a result women literacy rate increases day by day in the country form past decade. The government of India for women education related implemented so many schemes and programmes in the country. For example: Ajeevika skills, night schools etc.

#### **HEALTH AND WELL-BEING:**

It is a concept, under this women & men having substantial differences in their access to sufficient nutrition, health care & reproductive facilities etc. In some rural villages still don't have health facilities because of non availability of facilities and non awareness of government schemes also.

### **WOMEN EMPOWERMENT SCHEMES:**

- BetiBachaoBetiPadhao Scheme
- One Stop Centre Scheme
- Women Helpline Scheme
- UJJAWALA SCHEME
- Working women Hostel
- Nari Shakti Puraskar
- Awardees of Street Shakti Puruskar 2014 & Awardees of Nari Shakti Puruskar
- STEP Programme
- Maternity Benefit Programme
- Mahila E- Haat
- Maternity police volunteers etc.

### **MAJOR PROBLEMS IN OVERALL DEVELOPMENT OF RURAL WOMEN:**

#### **1. Access to resources (Land) Limitedly:**

Resources (land) are the most important resource for the upliftment of women in all fields. Though the legislation of India permits equal right of man & women in property yet but rural women still do not have ownership on land and the pattas are allotted in the name of their husband. Due to this reason women can't take independent decision on various aspects.

**2. Access to input & credit limitedly:** Rural women make contributors' to agricultural their access input credit is limited. For promoting women's access to farm input & credit following points to be taken;

1. Provide credit facility to rural women for agricultural land.
2. To conduct credit camps in villages especially for rural women.
3. Provide awareness & full knowledge about existing loaning policies of NABARD etc.

#### **3. Inadequate technical competency:**

women are involved in all agricultural operations, yet, they have inadequate technical competency due to their limited exposure to outside world.

- Renewable energy sources
- Seed production technology
- Use of fertilizer
- Post-harvest management

#### **4. Poor participation in decision making:**

Generally, decision will be taken the head of the family called karta. Women participation in decision making is limited. In rural women are not taken decision making because of lack of knowledge & economic independence.

#### **5. Limited exposure to mass media:**

The technology approach mainly includes mass media are not paying adequate and timely agricultural information to the farm women.

#### **WOMEN DEVELOPMENT PROGRAMMES:**

Rural women have been enabled to actively involve all activities of the household. If you empower rural women economically to use as a tool of Self Help Groups (SHGs). With these SHGs, tries to ensure the awareness about the role of savings, credit and alternative sources of finance. By organizing women form one group called Self Help Groups, women can start saving as a group, and create their own savings reservoir. The savings are provided as loan for each individual in the SHG.

Money is deposited in the beginning as savings each week or month by each member of SHG depending on the regulations. The SHG has become more organized and operative, that increase in their collective savings. Most groups are linked to the block level, and undertake income-generating activities. The Government provides loans to recognized SHG federations though a government established revolving fund. This extends their economic empowerment significantly the individual members of the SHG groups.

SHGs have assumed responsibility for development activities such as ensuring regular immunization from government health services, growth monitoring, proper functioning of the village education centre and regular attendance of children, management of community toilets, and village cleanliness.

The following are the main development programmes:

- Dairy Development: Dairy development programme it is a well income generation programme in rural areas. Under this scheme in rural areas dairy firms are incorporated and develop the buffalos in rural areas. It is the most important income generation source of women development as well as rural development.
- Livelihood Activities: In this handloom programmes, tailoring and beauty par lour etc.
- Goat Rearing: the rearing of goats is another secondary source of income generation of rural poor families.
- Agricultural activities: It is the main important source of livelihood in many villages. Rural villages' main cultivations are cotton, mirchi and pulses etc.
- Small Business Development: to promoting individual and group enterprises for strengthening women's groups in rural villages. Example of entrepreneurial activities in the rural areas of coir making, shoe making ,prawn and fish selling ,mushroom cultivation ,feed shops ,saree sales etc.

□ Micro finance and Micro Credit: Micro finance plays a important role in the development of the poorest of the poor and marginalized. The goal is to reduce and eradicate poverty and empower women in rural areas. The poor people joined in the community –based institutions but the capacity of the credit did not raise them to the level of self-reliance.

SHG's members took loans from the groups, but the loans did not fulfill their needs. The main objective of micro credit federation is to federating the SHG's has to promote a financially viable member managed mutual benefit micro credit delivery institution at the grassroots level. The following are the basic objectives of federation:

- \* To have better access to development information.
- \* To help in achieving sustainability of SHG'S and federation
- \* To support and strengthen self help groups and its leaders through training, information dissemination, on –site support etc.

### **VARIOUS EARNING OPPORTUNITIES IN RURAL AREAS:**

- Formation and Training of Self Help Groups
- Capacity Building –
- Income Generation Activities
- Credit and Savings Mobilization
- Group Development
- Establishment of linkages
- Livelihood programmes

### **SELF HELP GROUPS (SHG'S):**

The study did on Prakasam dist, Andhra Pradesh, India, where used as a tool of poverty alleviation and rural women empowerment is Self Help Group(s). A SHG is a small group of persons who come together with the intention of finding a solution to a common problem with a degree of self-sufficiency. The federation of women SHGs called 'Sangamon' was formed by the members themselves. It decided to start a supermarket and a building was constructed. As a share of Rs.10, 000 was collected from each SHG.The federation has assumed maximum responsibilities.

Self Help Groups (SHGs) means the organized forum of people and which is planned, shaped and structured by the people themselves to attain present/pre-identified goals and purposes.Many SHGs come together on one platform at local, regional, and district levels, which enables the groups to gather strength not only to influence the legislature but also to mobilize public opinion &gaining adequate space and opportunities for the community members to respond to various complex issues concerning their livelihoods.

### **Functions of SHGs:**

SHGs being the facilitators of social development, they have undertaken multidimensional activities including:

- Development of perspectives at local level;
- Identification and organization of developmental activities;
- Ensuring effective participation in the development activities;
- Documentation and dissemination of success and failure in development;
- Engaging in networking/collaboration and linkage with developmental institutes;
- Promoting people's organizations; not only as a 'project' but also as a process
- Capacity building; • Leadership development, participatory research and analysis;
- Participatory monitoring and evaluation;
- Access to information;
- Improving livelihood;
- Advocacy.

One major form of SHG that is popular in India is the savings and credit group model.

## **2. Need for SHG Formation:**

Main formation of SHG's is changing the lives of poor women in enhancing their incomes and increasing their self-esteem. Another reason is women are an important part of the community, it is necessary to build and enhance their capabilities to manage community projects. Empowering women by enabling them to work together as a collective agency.

**Objectives:**The following are the objectives of SHG's.

- To save money on regular basis.
- To mutually agree to contribute a common fund in order to meet their emergency needs.
- Takes decisions collectively.
- To solve conflicts through mutual discussion.
- To provide collateral free loan at the market driven rates based on the terms and conditions decided by the group.

## **Features of SHGs:**

SHGs consists not less than five persons and a maximum of twenty with similar economic outlook and social status. SHGs promote objectives like economic empowerment. It helps in raising resources for development and freedom from exploitation. The nature of SHGs is mostly informal (unregistered). Sources of funds for the SHGs accrue from member's savings, entrance fee, interest from loans, and income from investments and so on. Funds accrued may be used for extending loans, carrying out social services etc. The savings of members are deposited in a bank with the name of group.

**Significant impacts of SHGs on empowerment of women:** The member of SHGs shows the following outputs:

- Improvements in literacy and numerical skills;
- Increase in awareness of basic legal rights;

- Awareness of development activities of government;
- Increase in self-confidence and enhanced social status;
- Economic empowerment and freedom from manipulate of money lenders, landlords etc.
- Enhanced decision making powers in the household affairs etc.

### **.Types of Self Help Groups/Community Based Organizations:**

The community based organizations try to involve all the people in various exercises. The Government nourishes mobilization and organization of the poor women and empowers them to address various issues concerning poverty. The formation and development of the Self Help Groups through ongoing efforts are made, especially DWCRA groups in the rural areas, DWCUA groups in the urban areas. The following are the main types of Self Help Groups.

- Mothers Committees,
- School Education Committees,
- Watershed Committees,
- Vanasamrakshan Smithies and
- CMEY groups.

Through these Self Help Groups, the women are able to apply their potential, prioritize their needs, and design and implement developmental initiatives. The government has to support the SHG for empowerment of rural women through formation of policies and programmes.

### **Andhra Pradesh Community Self Help Model Centre for Good Governance:**

This Centre acts as controller, because it provides the poor with the space and support necessary to take steps towards control of their lives in private and in society. This Centre community based groups improves managerial skills, confidence among SHG members to get involved in issues & programmes in the public & private sectors.

### **SHGs organized for employment generation:**

In rural areas, rural people especially suffer from low incomes and high unemployment but also low levels of literacy and poor health conditions as well as poverty. Behind this reason government planned to form SHG's in rural areas because it had taken advantage of rural women to set up viable self – employment ventures, to earn additional income. There are more than 20 lakh women from poor families who have become members of these groups. The majority of them save one rupee a day.

### **DISCUSSION & RESULT OF THE STUDY:**

The empirical study done by prakasam dist Andhra Pradesh state for empower of rural women. The empirical study explains rural women can be improved through formation of self help groups and providing various earning opportunities in rural villages. For rural empowerment related so many schemes, programmes

are implemented in the state like Beti Bachao Beti Padhao, skill development programme, handloomprogrammesetc. Andhra Pradesh government has been following economic reforms to step up rural growth and rural empowerment. Behind that reason AP government recognized the value of forming small groups of poor people who have a common desire to generate livelihood options.

**SHG's:** SHGs consists not less than five persons and a maximum of twenty with similar economic outlook and social status. SHGs promote objectives like economic empowerment. It helps in raising resources for development and freedom from exploitation. The nature of SHGs is mostly informal (unregistered). Sources of funds for the SHGs accrue from member's savings, entrance fee, interest from loans, and income from investments and so on. The State Government is consciously making an effort to assist these SHGs by providing Revolving Fund under DWCRA. The DWCRA scheme has helped women earn additional monthly incomes, in addition to the economic betterment of their families.

For this study, I observed that one of the village i.e. podili, SHG's formation and functionalities in prakasam dist. In this SHG's total ten members are there. In these ten members to deposit or saving every month for each member Rs.2500/-. After savings the total amount is 15000/-. If in this group any person facing any emergency financial problem, she will be take this amount with other member's permission and utilize this amount for her own purpose without paid any interest amount.



DWCUA group photo - podili village in Prakasam dist, AP - SHG'S members

### **One of the earning opportunity source for women –MGNREGS:**

With the help of MGNREGS most of the people in rural villages earn incomes for doing the work. It is most important weapon and source for rural villages in present days. This scheme government of india implemented for the purpose of providing 150days work nature for rural poor people.



Women earning of money though MGNREGS work in indlcheruvu village in prakasam dist,AP

In prakasam dist ,some rural village women participated women empowerment programmes for their all round development. The below images shows women participation at women empowerment programmes in prakasam dist,Andhra pradesh state.



Women empowerment programmes conducted in Aravallipadu village& Indlacheruvu village in prakasam dist,AP

Now a day's women are entering in all sectors for their economic & social development of the family. Especially in rural areas, a rural woman faces lot of problems like agricultural, family, societal& education etc. Behind this reason the study focused to empower rural women and to face their own problems as well as socio-economic problems and strengthening their lives.

#### **Other Income Generating Activities in Prakasam dist:**

In prakasam dist, so many rural women actively participated other income generating activities like plantation of flowers, cool drink shops, fancy shops, dairy forms, poultryforms, selling of fruits and vegetables etc.



Plantation of banthi flower, Under plantation managerat Mungapadu village,Prakasam dist,AP

**Agricultural activities:** It is the main important source of livelihood in many villages. Rural villages' main cultivations are cotton, mirchi and pulses etc. For example under this image shows cultivation of crop in the field at cumbum village,prakasam dist,ap.



Former at Cumbum village,Prakasam dist,AP, Cultivation of Cotton Crop in the field

**Dairy Development:** Dairy development programme it is a well income generation programme in rural areas. For this study I directly observed in giddalur village,prakasam dist one of the rural family village formed dairy development plant in their place.



Dairy (Buffalo) development plant in giddalur village prakasam dist,AP.

Under this study, I went to some rural villages, prakasam dist, AP, i.e., indlacheruvu village, mungapadu, podili, aravallipadu, peddanapalem, cumbum, Giddalur etc. After completion of the empirical study I observed the following points.

**Important observed points:**

- \* In aravallipadu village, prakasam dist, some rural women mainly depended on agriculture works, cool drink shops etc. In this living village women people using these resources only.
- \* In giddalur village, most of the people especially women depend on own business like tailoring, beauty parlour, fancy shops, grossary shops, and chicken shops etc.
- \* In cumbum village, most of the women depend on agriculture and other income generating activities, like auto riskshaw, own business fancy, kiran stores etc no other sources are not there.
- \* In indlacheruvu village, their income sources are agriculture and MGNREGS works etc. No other sources are not there in this village.
- \* Like this so many villages are there in prakasam dist, overall in this district women empowerment sources are Agriculture, MGNREGS works, other own business, bank loan, SHG's and other income generating activities only except these other resources are not there.
- \* In these villages except MGNREGS scheme other income improvement schemes are not there like livelihood projects, skill development etc.

So, this study gives support to the rural women for their all-round development of in all sectors and wants to become develop in all sectors like education, employment, income status etc. This study expressed when we are forming the SHG's in rural villages and it gives financial improvement as well as additional income generation support to rural women. Another reason for doing this study is to do supportive plan or strategy for empower of women for all round to provide various earning opportunities like group development, capacity building, credit and savings generation etc. These all reasons might be cause for women development, and economic development of the country. I conclude that rural women empowerment refers all round development of rural women especially socio-economic opportunities.

**FINDINGS:**

- \* In prakasam dist, AP State, I directly observed some villages like munagapadu, indlacheruvu, Aravallipadu in these villages women earn money from based on MGNREGS works, agriculture only and no other income generation activities are not there.
- \* In indlacheruvu village, women people have less earning opportunities and they don't have enough money for putting new own business like cool drink shops, fancy shops, education for children etc.
- \* In giddalur and cumbum villages not haven that much of earning generation activities and not implemented government schemes in proper way
- \* The prakasam dist is one of the backward areas of AP state. In this dist so many problems is there. When we are removing these problems in dist then only we get women empowerment in this dist as well as state development.
- \* After completion of this study, I conclude that women empowerment impacts the country's Indian economy also because women are empower all the way their income level and financial status changes so automatically their percapita income, national income also changed. It may be caused for impact on Indian economy of the country.

## **RECOMMENDATIONS:**

- \* I strongly recommended that in indlacheruveu aravallipadu, munagapadu, cumbum and giddalur villages depends on agriculture, MGNREGS works related income sources only. So it has to be improved income generation activities in these villages and implement further more government schemes in these villages.
- \* For women empowerment, everyone should take responsibility for all round development of their lives.
- \* The rural women also proper utilize present resources and government implemented programmes/schemes for better development of women and country.

## **CONCLUSION:**

As a result that rural women empowerment could be achieved through SHG's & various earning opportunities in rural areas. Rural women play an important role in family not only family in the society, also. Women pursuing so many roles i.e. lady, wife, mother lives like a role model for their children, society and world. So women have faced lot of responsibility during her life. So it is not problem for empower of women in all sector with the help of government of ap and India. From this study we empower rural women through the mentioned ways. Anyhow rural women empowerment plays a pivotal role in these days.

Our empirical study observed that when you are empowered rural women in all aspects like; education, employment, culture, societal, health, skill development, livelihood programmes, business development etc they improve self and improve their family members also. These developments causes for all round development of the rural women families as well as villages

After completion of this study, we conclude that (SHG'S AND VARIOUS EARNING OPPORTUNITIES) these are tool or techniques and way for women empowerment in all fields and sectors.

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# Vein Graft Myringoplasty in small and medium sized Perforations

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## ABSTRACT

**Aim:** To establish vein graft as an alternative to the commonly used temporalis fascia with respect to the graft uptake and hearing improvement.

**Methodology:** Twenty patients with a small and medium sized central perforation, not involving more than 2 quadrants of the TM in the pars tensa underwent myringoplasty with vein graft harvested from the dorsum of the hand. The evaluation of hearing was done preoperatively and the amount of air-bone (AB) gap at 0.5, 1, 2 kHz was the parameter for evaluating hearing status. The outcome was evaluated after 1 month, and 3 months and 6 months.

**Results:** The patients were divided into three age groups (A: 15-30, B: 31-40 and C: >40 years). The mean age of patients observed in the study was  $24.7 \pm 7.62$  years (range: 17-45 years). Overall successful graft uptake rate was found to be 85% at the end of 6<sup>th</sup> month. On statistical analysis there was no significant difference found in different age groups regarding the graft uptake and hearing improvement.

**Conclusion:** The graft uptake of 85% and a considerable improvement in hearing makes vein grafts an alternate and equally effective to the commonly used temporalis fascia as graft material for myringoplasty.

**Key words :** myringoplasty, temporalis fascia, vein graft

## INTRODUCTION

Perforation of the tympanic membrane primarily results from middle ear infections, trauma or iatrogenic causes. Up to 80% of these perforations heal spontaneously.[1] Myringoplasty is a reconstructive operation of the tympanic membrane performed to prevent recurrent ear discharge and to improve hearing loss caused by tympanic membrane perforation.[2] The first surgical closure of tympanic membrane perforation, including removal of epithelium and grafting by skin was performed by Berthold in 1878, and he used the term Myringoplastic for this operation.[3]

In 1950s, Zollner [4] and Wullstein [5] reintroduced Myringoplasty. This period witnessed an improvement in surgical techniques with improved optics and emergence of microsurgery, thus making the Myringoplasty safer and lowered the rate of graft rejection.

A variety of autografts, allografts, xenografts, and alloplasts (temporalis fascia, tragal perichondrium, bovine pericardium, etc.) have been used for that purpose.[6,7]At present, the most frequently used graft is autologous temporalis fascia, which has been used in myringoplasty since the 1960s. [8]

The use of vein grafts for myringoplasty was first described by Shea.[9] Vein graft is readily available from any site of the body, commonly used is the dorsum of the left hand. Though, there are many different kinds of techniques and graft materials used, a survey of literature does not establish indisputably that a particular method is superior to the other. In the literature success rate of myringoplasties with temporalis fascia, vein graft, cartilage and perichondrium ranges 80–90 %. There are conflicting reports, which claim superiority of one procedure over the other.[10]

This is a prospective study and Purpose of this study is to determine the efficacy of vein graft in TM perforations, also to establish vein graft as an alternative and equally effective to the commonly used TM fascia graft.

## **MATERIALS AND METHODS**

### **Study population and preoperative evaluation**

The present study was conducted in the Department of Otorhinolaryngology, Silchar Medical College, Silchar, on 20 patients of either sex, Between April 2014 to march 2015, in the age group of 15-50 years with a small and medium sized central perforation, not involving more than 2 quadrants of the TM, Having dry ear over a period of at least 6 weeks without use of topical or systemic antibiotics. Any focus of infection in the nose and PNS were ruled out. Anesthesia was given according to the choice of the patients, 5 patients were done under general anesthesia and 15 under local anesthesia. All the patients were done through transcanal approach.

All patients were informed about the place from where the Vein will be harvested (dorsum of left hand). Informed consent was obtained after discussion of the alternatives. The approval of the institutional review board was obtained. Twenty patients were included in this study (10 males and 10 females). Fifteen patients had unilateral, and five patients had bilateral perforations. All patients underwent ENT history taking, a thorough clinical examination, audiometric and Eustachian tube function testing and laboratory preoperative testing and X-ray mastoid. The evaluation of hearing was done preoperatively and the amount of air-bone (AB) gap at 0.5, 1, 2, 4 kHz was the parameter for evaluating hearing status.

### **Surgical technique**

The osteocartilaginous junction of the external ear canal was infiltrated with 2 ml of 2% lidocaine with 1:100,000 epinephrine divided at 4 different sites 3, 6, 9 and 12 O'clock positions. The VG was harvested from the dorsum of the left hand as described by H. Tabb[11] shown in figure 1 & 2.

The VG was placed in such a way that the endothelial surface faced medially. The edges of the perforation were excised with a sickle knife or with a Rosen needle and were removed with microforceps. All the cases were performed through post auricular route by underlay technique.

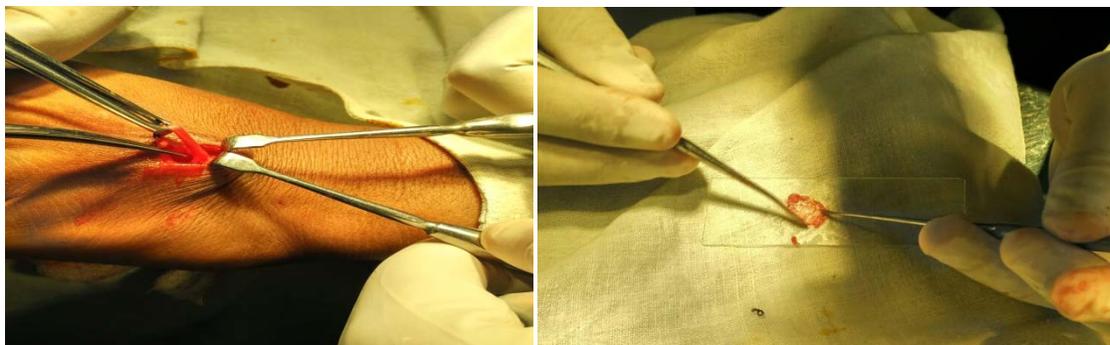


Figure 1 : harvesting vein graft.

Figure 2: preparation of the graft.

A large typanomeatal flap based on superior vascular pedicle was elevated along with the annulus. The graft was placed over the handle of the malleus medial to the annulus. Small pieces of absorbable gelatin sponge were inserted under the typanomeatal flap into the middle ear. Ear was packed with gel foam and antibiotic soaked aural pack. Aural pack removed after 7days. Sutures were removed after 1 week. Postoperatively, hearing status was evaluated at 0.5, 1, 2 and 4 kHz and any change in the AB gap was noted.

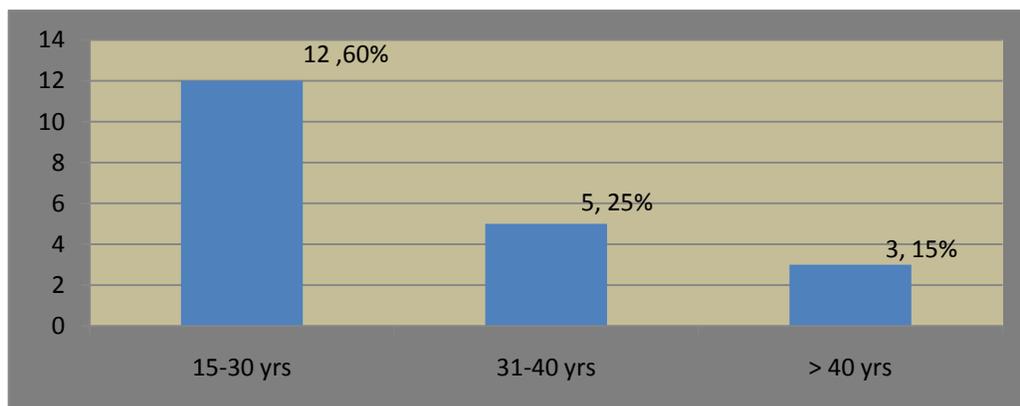
### Statistical analysis

The obtained data were compiled. Results were statistically analyzed by using the Chi-square test to assess the surgical outcome and the paired *t*-test to assess the audiological outcome.

### Results

The patients were divided into three age groups (A: 15-30, B: 31-40 and C: >40 years). The mean age of patients observed in the study was  $24.7 \pm 7.62$  years (range: 17-45 years). Of 20, 12 (60%) were in the age group of 15-30 years, 5 (25%) were in the age group of 31-40 years and 3 (15%) were in the age group of 35 years and above. [ Dig-1] The gender ratio male versus female was 1:1 (10 of each sex). Five patients (25%) had bilateral TM perforations. Among the 20 patients 12(60%) were presented with ear discharge, 5(25%) with ear ache and 8(40%) with hearing loss. 15 patients presented with unilateral TM perforations and 5 with bilateral TM perforations. Overall successful graft uptake rate was found to be 85% at the end of 3rd month. Among 10 males it was 90% and in 10 females it was 80%. Out of 5 patients who had bilateral disease, all 5 (100%) showed graft uptake, whereas in unilateral disease 12 out of 15 patients (80%) showed graft uptake. No difference was observed in the healing of bilateral and unilateral chronic suppurative otitis media cases and in both sexes.

Graph 1: showing various age distributions in patients.

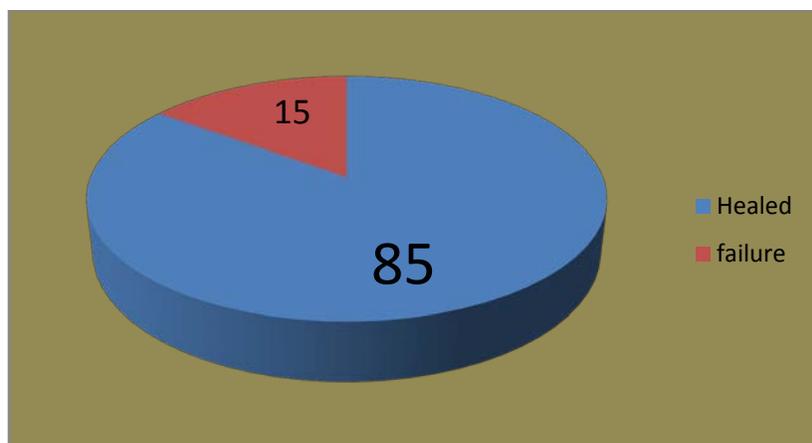


**Table 1: showing various presenting symptoms**

Presenting symptoms	Vein graft n=20	Percentage %
Ear discharge	12	60
Ear ache	5	25
Hearing loss	8	40

**Table 2: showing tympanic membrane perforation in affected ear**

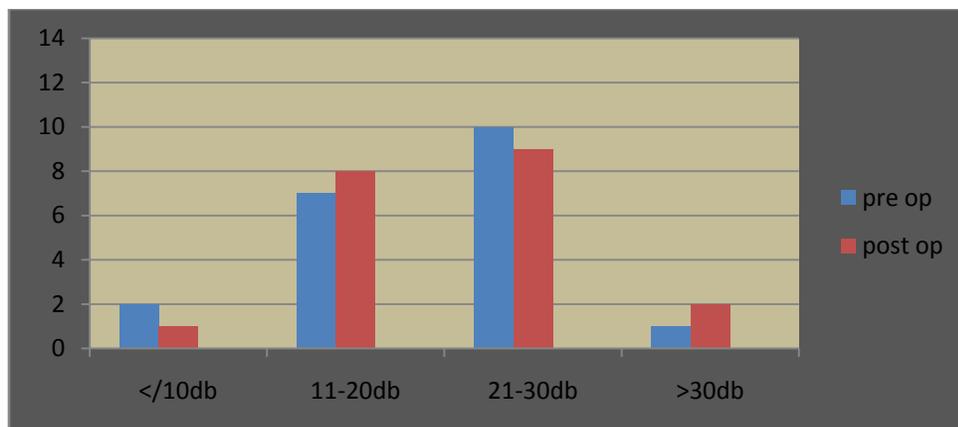
Ear affected (tympanic membrane perforation)	n = 20	Percentage %
Right	6	30
Left	9	45
Bilateral	5	25



**Graph 2: the number of graft take up as compared to graft failure.**

Pure tone audiometry was used to assess average AB gap pre- and post-operatively. Mean preoperative AB gap was  $23.54 \pm 5.65$  dB (range: 10–35 dB). Mean postoperative AB gap was  $21.40 \pm 4.23$  dB (range: 10-37 dB). Mean improvement in AB gap was  $2.14 \pm 1.42$  dB. When the difference was analyzed statistically using paired *t*-test. There was no difference between the audiometric improvement in both sexes.

Age group wise postoperative improvement in AB gap in 15-30 years was 5/9 (55.5%), in 30-40 years was 2/4 (50%) and in >40 years group it was 1/3 (33.3%). There was no significant difference found between audiometric improvement in different age groups following vein graft myringoplasty in successful patients.



**Graph 3: Comparison of pre and post operative air bone gap on pure tone audiometry**

**DISCUSSION**

Myringoplasty is the surgical procedure to repair tympanic membrane perforations and thereby improving hearing, providing a dry ear and reducing susceptibility to infections[12]. Success in myringoplasty is usually assessed in terms of healing of the perforation as well as hearing gain [12,13]. Myringoplasty is successful when there is no infection in the middle ear, mastoid, nose, PNS and if present it should be treated prior to surgery. DNS, sinusitis, nasal polyp should be treated surgically to get good results in myringoplasty. A critical problem early in the development of myringoplasty was finding a suitable material for tympanic membrane grafting. This evolution of the tympanic membrane grafting has been based on biological tissues of mesodermal origin which contain collagen matrix.[14] The use of vein grafts for myringoplasty was first described by Shea [9]. Heerman was the first to use temporalis fascia for myringoplasty [12]. Since then myringoplasty surgery came a long way adopting various techniques and innumerable graft materials to close the tympanic membrane perforations.

Tragal perichondrium was introduced by Goodhill et al the results showed that tympanic membrane healing rates were 80% when temporalis fascial grafts were used and it was better when perichondrial graft (88%) were used and even better when composite grafts were used (92.3%).[13]

The cause for the failure is attributed to lack of elasticity and decreased resistance to pressure changes in middle ear and external ear in case of temporalis fascia.

Skin grafts were the first graft materials used in myringoplasty, by Horst Wullstein and Fritz Zollner (1952). However, they were discontinued from use because of high failure rates and formation of cholesteatoma. Fascia lata and temporalis fascia were established as the preferred materials for tympanic membrane reconstruction.[17]

Homografts have also been used extensively and include cadaveric tympanic membrane, pericardium, duramater, formaldehyde preserved temporalis fascia, and sclera.[17] Homografts are not preferred now because the risk of transmission of Creutzfeld-Jakob disease.[18]

Ringenberg used free autologous fat graft in the early 1960s.[19]

Austin DF (1963) in a series of 503 tympanoplasties performed 190 myringoplasties with vein graft. 117 were re-examined 12 month later. There were 14 failures and 89% of these the cases was air- bone gap of 0-20 db.[31]

With respect to limitations, homologous vein grafts do not appear to survive on raw soft tissue surface. The following table shows success rate achieved by different authors using vein graft material:

Author	Year	Success in %
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Livingstone <sup>32</sup>	1961	100%
Gulliford <sup>33</sup>	1962	95.7%
Austin <sup>31</sup>	1963	82%
Wright <sup>34</sup>	1963	93.5%
Nickel <sup>35</sup>	1963	82%
Smyth <sup>36</sup>	1964	96%

Myringoplasty can be performed using either overlay technique or underlay technique [12,13]. The underlay method can be achieved by either trans-canal approach or post-aural approach.

Patients with small or moderate central perforations were included in the present study because of the fact that limited size of the autologous VG, which would be insufficient to close larger perforation [9, 21]. Shea who first used VG advised not to use VG if the defect in the tympanic membrane is occupying more than 40 % of the tympanic membrane area [9]. It is difficult or impossible to bridge a large perforation by VG [20,21]. The failure rate was high while repairing large tympanic membrane perforations, using VG [20,21]. It is obvious from the various studies that VG are suited for small or moderate size perforations [20,21]. High failure rate (6.5–20 %) has been reported with larger perforation irrespective of grafting material used [20, 22]. But according to study of Wasson et al. [23] neither perforation size nor any other assessed variable was a statistically significant determinant factor for successful myringoplasty. Inactive ears were preferred for the study to rule out the focus of infection and resultant graft failure. However, Adkins and white [22] found in his study that preoperative dry intervals do not influence the outcome of the surgery.

In all our cases myringoplasty was done by underlay technique and a post aural approach. The vein graft was harvested from the dorsum of the hand and placed with the endothelium facing medially. We found that harvesting and preparing the graft was not a time taking cumbersome procedure. Shea [9] and Tabb [11] have reported the use of VG with endothelium inwards because endothelium facing inwards minimizes adhesions and the rough sticky adventitia adhering well to the prepared inner drum margin. Nickel [24]

P.K.Parida et al compared vein graft and temporalis fascia graft and he found both VG and TFG have proved to be equally efficacious in terms of graft take up 83.3% and hearing improvement 70% when used in myringoplasty for small or moderate size tympanic membrane perforation.[25]

In our case the overall success rate for graft uptake at the end of 3<sup>rd</sup> month was 85 percent. It was 90 percent in male patients and 80 percent in female patients. In cases of bilateral perforation graft uptake was 100 percent and unilateral cases it was 73.33 percent. The success rate for vein grafting in our study is as good as temporalis fascia graft as mentioned in various other studies [26,27,28,29].

Improvement in hearing was assessed by doing a pre operative and post operative audiogram. The preop AB gap was 23.54 ± 5.65 dB (range: 10–35 dB) as compared to post op AB gap which was 21.40 dB ± 4.23 dB (range: 10-37 dB). It was observed that mean improvement in hearing was 2.14 dB ± 1.42 dB. Our findings support current literature that autologous vein graft can be successfully used in cases of CSOM with small to medium sized perforations. The results in our study with vein graft is comparable to temporalis fascia grafting as suggested in various other studies [30]

**CONCLUSION:**

The graft uptake of upto 85 percent and a significant improvement in hearing as assessed by pre and post op audiogram suggests that vein grafts can be safely used for myringoplasties of small to medium sized perforation. The results are as good as myringoplasties done with temporalis fascia and other available common graft materials.

In prospective of post operative scarring with a very minimal scar over the dorsum of hand makes it a cosmetically suitable and efficient grafting technique over other techniques.

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# Arcuate Line of Douglas: Localization from Surface Anatomic Landmarks of Anterior Abdomen during Laparoscopic TEPP Hernioplasty

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## Abstract

Surface marking of the arcuate line of Douglas has attained surgical importance not only in the open surgery including rectus abdominis flap harvest and stoma formation but also the laparoscopic surgery such as the total extraperitoneal preperitoneal (TEPP) inguinal hernioplasty. Present study used four surface landmarks (Umbilicus, pubic symphysis, xiphisternum and anterior interspinous line, the line joining the two anterior superior iliac spines) during TEPP hernioplasty to assess the location of the arcuate line. Mean distances of the arcuate line from the umbilicus, pubic symphysis, xiphisternum and interspinous line were  $5.37 \pm SD 1.62$  cm (Range 2.5-11.5 cm),  $10.67 \pm SD 2.44$  (Range 1.5-14.5 cm),  $20.11 \pm SD 1.88$  (Range 15.5-26.5 cm), and  $3.71 \pm SD 2.32$  (Range, -1.5 to 9.5 cm). Arcuate line was found located at  $2/3^{\text{rd}}$  of the pubis-to-umbilicus distance and at  $1/3^{\text{rd}}$  of the pubis-to-xiphisternum distance, confirming the recent reports. Upper border of the pubic symphysis is recommended as the optimal reference point as compared to other three surface landmarks for surface marking and localization of the Arcuate line of Douglas, albeit with a little caution in the overweight /obese patients.

**Index Terms:** Arcuate line level, surface marking, TEPP hernioplasty, rectus abdominis flap, stoma formation

## 1. INTRODUCTION

Exact preoperative localization of Arcuate line of Douglas, the lower crescent border of the incomplete posterior rectus sheath, is relevant

before harvesting the TRAM (transverse rectus abdominis myocutaneous) flap during reconstructive surgery for breast, etc., and harvesting the muscle cranial to the level of the arcuate line is likely to prevent the postoperative incisional hernia (Rizk, 1991; Salgado et al, 2000; Cunningham et al, 2004; Lipa, 2007; Mwachaka et al, 2010; Pipkorn and Nussenbaum, 2017). Knowledge of arcuate line position is an important during stoma siting because making the stoma site above the arcuate line is likely to reduce the risk of postoperative parastomal herniation (Al-Momani et al, 2014). Arcuate line is also important surgical landmark open ventral hernia repair (Johnson et al, 2014) Moreover, the arcuate line has attained paramount surgical importance as an essential anatomic landmark to guide the surgical dissection during the laparoscopic total extraperitoneal preperitoneal (TEPP) hernia repair (Spitz and Arregui, 2001; Ely and Arregui, 2003; Meyer et al, 2010; Putnis and Berney, 2012; Iuoamoto et al, 2015; Abd-Raboh et al, 2017).

It is ironical that the medical students are still taught in the anatomy classroom the classical location of the arcuate line at half of the umbilico-pubic distance (Warwick and Williams, 1973; Strauch and Yu 1993; Cunningham et al, 2004; Farquharson et al, 2015), although current anatomic literature provides evidence for its more proximal position (Cunningham, et al, 2004; Loukas et al, 2008; Ansari, 2017a,b). Skandalakis et al (2006) opined that the exact location of the arcuate line is debatable. The variable positions of the arcuate line reported in the older as well as the recent literature may stem from the fact that the position of the arcuate line is traditionally measured from the umbilicus but the position of the umbilicus itself is not fixed and highly variable in individuals of

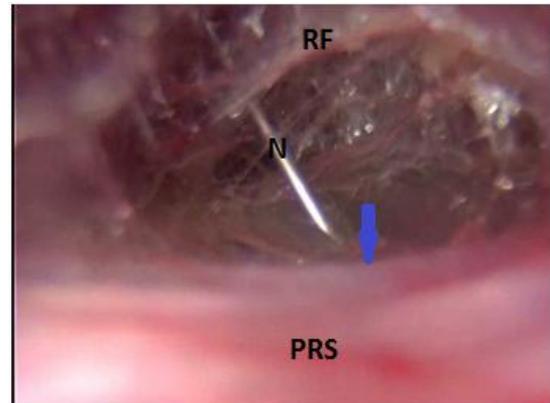
different body habitus. Present study measured the arcuate line position in relation to not only the umbilicus but also the fixed bony abdominal landmarks of pubic symphysis, xiphisternum and anterior superior iliac spine.

## 2. MATERIALS & METHODS

A prospective doctoral research for award of PhD (Surgery) was designed and carried out in the Department of Surgery, J. N. Medical College Hospital, A.M.U, Aligarh (India) since April, 2010 and completed in November, 2016. Patients with uncomplicated primary inguinal hernia undergoing laparoscopic total extraperitoneal preperitoneal (TEPP) hernioplasty under ethical clearance and informed consent were studied in the period from February, 2011 when the first case of TEPP hernioplasty was done, to November, 2016. Criteria for selection/ inclusion/ exclusion into/from the study and surgical technique of 3-midline-port for laparoscopic TEPP hernioplasty were consistently same as reported earlier (Ansari, 2013; Ansari, 2015; Ansari, 2017a,b,c).

The patient was anaesthetized with relaxant general anaesthesia with endotracheal intubation. Then the lower border/tip of the xiphisternum, the upper border of the pubic symphysis and the anterior superior iliac spines (ASIS) were marked after painting and draping of the abdomen. The distance between the lower border of the umbilicus and the upper border of the pubic symphysis (U-PS) and the distance between the tip of the xiphisternum and the upper border of the pubic symphysis (Z-PS) were measured with a sterile stainless steel scale. The anterior interspinous line was also drawn horizontally between the two ASIS. A small vertical/transverse incision was then given in the midline at about 2.5 cm below the umbilicus, the ipsilateral anterior rectus sheath opened and then the ipsilateral rectus abdominis muscle was retracted laterally. First 11-mm blunt optical port was then placed in the ipsilateral retromuscular space and air-seal was obtained with a strong silk ligature (1-0) over a gauze piece. CO<sub>2</sub> insufflation was started at a pressure of 12 mmHg. A 10-mm 0° laparoscope was put in the posterior rectus canal and controlled gentle telescopic dissection was performed. Posterior rectus sheath were carefully visualized and its termination was documented. Position of the arcuate line, if present, was ascertained by the percutaneous needle insertion (**Fig. 1**) and its distance was measured flat from the umbilicus, the xiphisternum, the upper border of the pubic symphysis and the interspinous line with help of the rigid scale. Body mass index (BMI) was calculated by the Deurenberg's formula

(Deurenberg et al, 1991). Microsoft Excel 2007 and Tools were used for the simple statistical analysis.



**Figure 1:** Dissection within Posterior Rectus Canal with Percutaneous Needle Confirmation of Arcuate Line: N, hypodermic needle inserted percutaneously at the level of arcuate line; RF, rectus fascia covering the rectus abdominis muscle anteriorly; PRS, incomplete posterior rectus sheath with formation of an arcuate line (arrow) posteriorly;

## 3. RESULTS

Sixty eight uncomplicated primary inguinal hernias (right side 17; left side 35; bilateral 8) were successfully operated by the laparoscopic TEPP technique through the posterior rectus approach in about five and half years. All patients were adult male. Incomplete posterior rectus sheath with formation of a terminal primary arcuate line (of Douglas) was observed in only 54 out of 68 cases, while in the remaining 14 cases, the posterior rectus sheath was complete extending upto the pubic bone with absence of the primary arcuate line. Secondary arcuate lines documented in 10 out of the 68 cases (3 cases with the incomplete posterior rectus sheath, and 7 cases with complete posterior rectus sheath) were excluded from data analysis for clarity of presentation and comparative evaluation.

Actual positions of the arcuate lines with respect to the umbilicus are depicted in **Table 1**. Mean distances of the arcuate line level from the umbilicus, the xiphisternum, the pubic symphysis and the interspinous line (line joining the two anterior superior iliac spines [ASIS] of the body) are presented in the **Table 2**, along with the mean distance from xiphisternum to pubic symphysis, from umbilicus to the pubic symphysis.

The arcuate line was found situated at an average location at about 1/3<sup>rd</sup> of the distance from the umbilicus to the pubic symphysis (U-PS) or about

2/3<sup>rd</sup> of the distance from the pubic symphysis to the umbilicus, and at the 2/3<sup>rd</sup> of the distance from the xiphisternum to the pubic symphysis (Z-PS) (**Table 2** and **3**).

Mean levels of the arcuate line with respect to the umbilicus (U-AL), the xiphisternum (Z-AL), the pubic symphysis (AL-PS) and the interspinous line (AL-ASIS) did not differ significantly ( $p > 0.05$ ) with respect to the age and the occupation of our patients. Pearson Correlations were also not statistically significant ( $p > 0.05$ ). However, mean levels of the Arcuate line (U-AL) in the normal-weight patients ( $BMI < 25 \text{ Kg/m}^2$ ) and the overweight/obese patients ( $BMI > 25 \text{ Kg/m}^2$ ) was  $5.68 \pm SD 1.52 \text{ cm}$  (range 3.5-11.5 cm) and  $2.63 \pm 0.25 \text{ cm}$  (range 2.5-3.0 cm) which were significantly different ( $p < 0.001$ ). Pearson Correlation was also very significant ( $p < 0.01$ ). All the same, the mean BMI of the patients with the classical, high and low positions of the arcuate line was also different significantly ( $p < 0.001$ ). Post Hoc Tests (Scheffe and Tukey HSD) revealed that BMI of patients with the high arcuate line was significantly much higher ( $p < 0.01$ ) as compared to those with the classical or low level of the arcuate line, and the difference between the later two was statistically insignificant ( $> 0.05$ ). Moreover, arcuate line measurements were dissimilar on the two sides of the body in half of the patients with bilateral inguinal hernias, but the mean levels were not different significantly between patients with similar levels and patients with dissimilar levels on the two sides of the body ( $p > 0.05$ ).

#### 4. DISCUSSION

Accurate knowledge of the arcuate location is essential not only in the open surgery in raising a rectus abdominis flap (Rizk, 1991; Salgado et al, 2000; Cunningham et al, 2004; Lipa, 2007; Mwachaka et al, 2010; Pipkorn and Nussenbaum, 2017) or stoma formation (Al-Momani et al, 2015), but also during the Laparoscopic TEPP repair for inguinal hernia (Spitz and Arregui, 2001; Ely and Arregui, 2003; Meyer et al, 2010; Putnis and Berney, 2012; Iuamoto et al, 2015; Abd-Raboh et al, 2017). However, despite apparent textbook accord, wide variation in the location of the Arcuate line (of Douglas) have been reported in the literature (Anson et al, 1960; McVay, 1974; Monkhouse and Khalique, 1986; Lange et al, 2002; Cunningham et al, 2004; Skandalakis et al, 2006; Loukas et al, 2008).

Current evidence suggest that the Arcuate line is generally located more proximal that its traditional location at half of the umbilico-pubis distance (Cunningham et al; Loukas et al, 2008; Ansari,

2015 and 2017a,b). Present study confirmed the average position of the arcuate line, if one is present, at 2/3<sup>rd</sup> of the pubis-to-umbilicus distance or 1/3<sup>rd</sup> of the pubis-to-xiphisternum distance which is in full agreement with the findings of Cunningham et al (2004) and Loukas et al (2008) (**Table 4**), and this location of the arcuate line has been endorsed recently by Rosen et al (2016) in the 41<sup>st</sup> edition of the Gray's Anatomy.

However, the position of the Arcuate line with respect to the anterior superior iliac spine (anterior interspinous line) was found significantly much higher in the present study as compared to the findings of Cunningham et al (2004) and Loukas et al (2008), although a few of them extended even below the interspinous line (**Table 4**). This discrepancy may be a reflection of different body habitus of the Indian population as compared to the Americans or Europeans. A minority of the Arcuate lines in our patients was situated either very high (5.6%), especially in the overweight/obese individuals, or very low (5.6%) (**Table 1**).

The umbilicus is not a fixed point and the interspinous line may be variable in different populations. Therefore both the umbilicus and anterior superior iliac spine may not be good reference points in preoperative assessment of the arcuate line position for planning of the relevant open or laparoscopic procedure as its assessment in a particular patient is subject to variation with respect to the body habitus of the person concerned. Moreover, the xiphisternum, although fixed in nature may also not be an adequate reference point for assessment of the arcuate line location for two reasons. Firstly, difficulty is encountered during the horizontal measurement of the distance of the arcuate line from the xiphisternum due to the anterior curvature of the anterior abdominal wall. Secondly, external measurement may not be a true internal measurement of the arcuate line due to the anterior abdominal curvature and abdominal wall thickness. Assessment of the arcuate line position with respect to the upper border of the pubic symphysis was found consistent and fully comparable between the present study and the previous studies (Cunningham et al, 2004; Loukas et al, 2008). Therefore, the upper border of the pubic symphysis is an optimal reference point for locating the position of the Arcuate line of Douglas, and hence strongly recommended for its use during the preoperative planning during the open reconstructive and stoma surgery as well as the laparoscopic TEPP hernioplasty. High definition preoperative imaging, if available, especially by an interested radiologist, may enhance the surgeon's confidence immensely for accurate marking and execution of the procedure.

## 5. CONCLUSION

Mean distances of the arcuate line from the umbilicus, pubic symphysis, xiphisternum and anterior interspinous line were  $5.37 \pm SD 1.62$  cm (Range 2.5-11.5 cm),  $10.67 \pm SD 2.44$  (Range 1.5-14.5 cm),  $20.11 \pm SD 1.88$  (Range 15.5-26.5 cm), and  $3.71 \pm SD 2.32$  (Range, -1.5 to 9.5 cm) respectively. Arcuate line was found located at  $2/3^{\text{rd}}$  of the pubis-to-umbilicus distance and at  $1/3^{\text{rd}}$  of the pubis-to-xiphisternum distance, confirming the recent reports (Cunningham et al, 2004; Loukas et al, 2008; Rosen et al, 2016). Upper border of the pubic symphysis is recommended as the optimal reference point as compared to other three surface landmarks for surface marking and localization of the Arcuate line of Douglas, albeit with a little caution in the overweight /obese patients.

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**Table 1: Distribution of Positions of the Arcuate Line from the Umbilicus**

S. No.	Arcuate Line Position From Umbilicus			Average Position of Arcuate Line (U-AL) (Mean±SD) (cm)
	Distance from Umbilicus to Arcuate Line (U-AL) (cm)	Number of Arcuate Lines (N)	Number of Arcuate Lines (%)	
1.	2.5	3	5.56	5.37±SD1.62
2.	3.0	1	1.85	
3.	3.5	3	5.56	
4.	3.75	1	1.85	
5.	4.0	3	5.56	
6.	4.5	6	11.11	
7.	5.0	6	11.11	
8.	5.5	11	20.37	
9.	6.0	10	18.52	
10.	6.5	7	12.96	
11.	8.0	1	1.85	
12.	10.5	1	1.85	
13.	11.5	1	1.85	
	<b>Total</b>	<b>54</b>	<b>100</b>	

(Adapted with permission from Ansari, MM. Thesis for PhD (Surgery) titled - "A Study of Laparoscopic Surgical Anatomy of Infraumbilical Posterior Rectus Sheath, Fascia Transversalis & Pre-Peritoneal Fat/Fascia during TEPP Mesh Hernioplasty for Inguinal Hernia", Aligarh Muslim University, Aligarh, India, 2016)

**Table 2: Levels of Arcuate Line (N=54) With Respect to Different Anatomic Landmarks in Patients with Incomplete Posterior Rectus Sheath**

S. No.	Distance	N	Mean (cm)	<sup>7</sup> S.D. (cm)	Range (cm)
1.	<sup>1</sup> U - AL	54	5.37	1.62	2.5 to 11.5
2.	<sup>2</sup> Z - AL	54	20.11	1.88	15.5 to 26.5
3.	<sup>3</sup> Z - PS	60	30.25	1.93	19.0 to 34.0
4.	<sup>4</sup> U - PS	60	15.74	1.41	11.5 to 18.5
5.	<sup>5</sup> AL - PS	54	10.67	2.44	1.5 to 14.5
6.	<sup>6</sup> AL-ASIS	54	3.71	2.32	-1.5 to 9.5

<sup>1</sup>U - AL, umbilicus to arcuate line; <sup>2</sup>Z - AL, xiphisternum to arcuate line; <sup>3</sup>Z - PS, xiphisternum to umbilicus; <sup>4</sup>U - PS, umbilicus to pubic symphysis; <sup>5</sup>AL - PS, arcuate line to pubic symphysis; <sup>6</sup>AL-ASIS, arcuate line to interspinous line (between two anterior superior iliac spines (ASIS)); <sup>7</sup>S.D., standard deviation. (Adapted with permission from Ansari, MM. Thesis for PhD (Surgery) titled - "A Study of Laparoscopic Surgical Anatomy of Infraumbilical Posterior Rectus Sheath, Fascia Transversalis & Pre-Peritoneal Fat/Fascia during TEPP Mesh Hernioplasty for Inguinal Hernia", Aligarh Muslim University, Aligarh, India, 2016)

**Table 3: Location of Arcuate Line with respect to Umbilicus, Xiphisternum, Pubic Symphysis and Interspinous Line in Adult Patients Undergoing Laparoscopic TEPP Hernioplasty**

S. No.	Measurements (Mean)	Location of Arcuate line (% of Distance)
1.	Umbilicus to Pubic Symphysis (U-PS) (15.74 cm)	34.12% of U-PS Distance
2.	Xiphisternum to Pubic Symphysis (Z-PS) (30.25 cm)	66.48% of Z-PS Distance
3.	Pubic Symphysis to Umbilicus (PS-U) (15.74 cm))	67.79% of PS-U Distance
4.	Pubic Symphysis to Xiphisternum (PS-Z) (30.25 cm)	35.27% of PS-Z Distance

U-PS, distance from the umbilicus to upper border of pubic symphysis;  
 Z-PS, distance from xiphisternum to upper border of pubic symphysis;  
 PS-U, distance from upper border of pubic symphysis to xiphisternum;

**Table 4: Comparative Analysis of Arcuate Line Location**

S. No.	Distance	Location of Arcuate Line			p-value
		Present Study (N=54)	Cunningham et al (2004) (N=32)	Loukas et al (2008) (N=200)	
1.	Pubic Symphysis to Umbilicus	66.48%	74.6%	70.2%	>0.05
2.	Umbilicus to Pubic Symphysis	34.12%	NA	NA	-
3.	Pubic Symphysis to Xiphisternum	35.23%	32.7%	33.9%	>0.05
4.	Xiphisternum to Pubic Symphysis	66.48%	NA	NA	-
5.	Superior to ASIS Line (Mean±SD)	3.71±2.32 cm (Range, -1.5 to 9.5)	1.8 ± 1.7 cm (Range, NA)	2.1 ± 2.3 cm (Range, NA)	<0.001

# An Assessment of the Practice of Vocabulary Teaching Strategies in EFL Classes: Kellem Secondary School Grade 9 and 10 English Teachers in Focus

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**Abstract-** The purpose of this research is to assess to what extent English language teachers practice vocabulary teaching strategies at Kellem Secondary school. The study particularly, tried to find out teachers' knowledge on the theoretical perspective of vocabulary teaching strategies, examine to what extent teachers practically use vocabulary teaching strategies in EFL classes and identify the major factors that might hamper the implementation of vocabulary teaching strategies in EFL classes. To this end, the study employed descriptive survey method, which involves both quantitative and qualitative methods. Accordingly, Kellem Secondary School was selected through availability sampling. Then, 13 English teachers from both grade 9 and 10 were selected purposefully for the interview, for the questionnaire and for classroom observation. In addition, data were collected from 90 randomly chosen students through questionnaire. Thus, descriptive statistics using frequencies and percentages were employed in analyzing the quantitative data and the qualitative data were analyzed qualitatively. Finally, based on the findings, the researcher recommended that creating meaningful vocabulary teaching opportunities through different vocabulary teaching strategies should be practiced widely in the school. The results of the study reveal that the teachers were not capable enough on the knowledge and the theoretical orientations of vocabulary teaching strategies in EFL classes. In addition, it was found that the teachers lacked practical skills on the implementation of different types of vocabulary teaching strategies in EFL classes according to their suitability. Furthermore, the study revealed that they rarely practiced these strategies during vocabulary instruction. Generally, the practices of vocabulary teaching strategies were not given sufficient attention at Kellem Secondary School. Thus, the study indicated that the English teachers didn't practice different vocabulary teaching strategies in EFL classes. Finally recommendations were drawn based on the above findings.

**Index Terms-** strategies, vocabulary, teaching, and practice

## I. INTRODUCTION

Teaching vocabulary is a significant issue in language teaching, since words play an important role in expressing our feelings, emotions, and ideas to others during communication. This means, without the mediation of vocabulary, no amount of grammatical or other types of linguistic knowledge can be employed in second language communication or discourse. But it was during the

communicative approach that the prominent role of vocabulary knowledge in second or foreign language learning has been highly recognized by researchers in the field. The current popular communicative approach of language teaching has emphasized meaningful interactive activities over form. It has also recognized that the vocabulary learning strategies that students use have greater impact on the success of their vocabulary learning (Hatch and Brown, 1995). Vocabulary is central to language and is of great significance to language learners because words are the building blocks of a language since they label objects, actions, ideas without which people cannot convey the intended meaning.

The prominent role of vocabulary knowledge in second or foreign language learning has been recently recognized by theorists and researchers in the field. Accordingly, numerous types of strategies, exercises and practice have been introduced into the field to teach vocabulary. It has also been suggested that teaching vocabulary should not only consist of teaching specific words but also aim at equipping learners with strategies necessary to expand their vocabulary knowledge (Nation, 2001). Although each strategy contributes to success or failure, consistent employment of certain types of strategy forms a means to vocabulary learning that may considerably influence the outcomes of L2 learning. Vocabulary knowledge is an important element in foreign language or second language acquisition. A student can increase vocabulary knowledge formally in the classroom and informally through communication with others and through out of class activities. So as to utilize this idea, devising and using instructional strategies needs to be used in teaching vocabulary (Woodard, 1998).

Therefore, teaching vocabulary is a significant factor in language teaching, since words play an important role in expressing our feelings, emotions, and ideas to others during communication. So, vocabulary plays very important role in the communication activity. In the absence of vocabulary, communication will not occur. Indeed, neither literature nor language exists without vocabulary (Harmer, 1991). On top of this, vocabulary is a primary concern for language teachers, applied linguists and etc. The strategies that teachers mostly practice in their language classes is to enhance their students' vocabulary knowledge or help them to be able to communicate by reading; speaking and writing on the basis of good command of vocabulary is very crucial (Anderson and Nagy, 1992).

It is true that vocabulary is central to a language and is of paramount importance to a language learner. Therefore, the interest of focusing on this vocabulary teaching strategy comes

from various reasons. In the first place, to the best of the researcher's knowledge, it is one of the significant areas language teachers raise as a problem in relation to the practice of vocabulary teaching strategies and secondly, as a language teacher, vocabulary teaching through different strategies is very vital in language teaching.

However, EFL teacher at Kellem Secondary School still seem to have problems in practicing different vocabulary teaching strategies due to the following reasons. Firstly, the learning experience of students Kellem high school. Secondly, there is inadequacy of the content of the text book to practice vocabulary teaching strategies fully which helps students develop their vocabulary knowledge.

In light of this, the purpose of this study is to assess English teachers' practice of vocabulary teaching strategies in EFL classes during vocabulary instruction at Kellem Secondary School and possibly attempts to assess the type of vocabulary teaching strategies frequently practiced. And finally, conclusions and recommendations would be given on how often different vocabulary teaching strategies should be practiced.

## II. OBJECTIVE OF THE STUDY

### General Objective

The general objective of this study is to assess the practice of EFL teachers' vocabulary teaching strategies in Kellem Secondary School of grades 9 and 10 classes.

### Specific Objectives

Based upon the main objective, this research is intended to achieve the following specific objectives:

- a) To identify the types of vocabulary teaching strategies Kellem Secondary School English teachers employ.
- b) To check up whether the practice of strategies in vocabulary teaching in EFL classroom basically practiced or not.
- c) To distinguish vocabulary teaching strategies preferred by the English teachers and students.
- d) To identify the factors that hinders the practice of vocabulary teaching strategies in EFL class

### Research Design

In this research, descriptive survey research design involving both qualitative and quantitative techniques was employed. These techniques were chosen because they could provide information concerning the status of the current practices of vocabulary teaching strategies in teaching and learning English as a Foreign Language (EFL) in the high school.

Therefore, both qualitative and quantitative techniques help the researcher to draw valid conclusions for advance planning of the methods to be adopted for collecting the relevant data and techniques were used during analysis.

### Sample Size and Sampling Techniques

The target populations of the study were grade nine and ten English teachers and students at Kellem Secondary School in Dambi Dollo Town - Qellem Wellega Zone. In line with this, 13 English teachers and 301 students from both grades were taken as a population for the study. So, the total population size is 314. But, the researcher has taken 30% of the students i.e 90.

The respondents were randomly selected from the total population of both grade students using the lottery method for questionnaire. Because it gives each element in the population an equal probability of getting into the sample; and all choices are independent of one another. And it gives each possible sample combination an equal probability.

### Study Population

The researcher decided to choose grade nine and ten English teachers and students for two reasons. The first reason is that the researcher believed that respondents at this grade level have a unique experience with regard to the English language at Kellem Secondary School, because grade nine students start to use English to learn other school subjects. The second reason is that the researcher didn't come across a study conducted on assessing the practice of vocabulary teaching strategies at the selected school; therefore, the researcher felt that the study would fill a gap.

### Methods of Data Analysis

The data which were gathered from teachers and students through interview, classroom observations and questionnaires was analyzed, interpreted and discussed accordingly. Quantitative data which were collected from the respondents were analyzed by using Statistical Package for the Social Science students (SPSS 16.0) software analysis, the quantitative data were collected through open ended and close-ended questions which were entered into the computer and statistically described in terms of standard deviation, mean, percentage and frequency. Finally, the qualitative data were analyzed thematically. Based on the results, conclusion and recommendations were given.

## III. RESULTS AND DISCUSSION

This study aimed at assessing the extent to which EFL teachers practice vocabulary teaching strategies in teaching English at Kellem Secondary School. To collect relevant data for the study, interview, and questionnaire and classroom observation were employed.

Accordingly the results and discussions of teachers' and students' responses, teachers' practices of vocabulary teaching strategies compared with the classroom observation were assessed. Finally, the major factors that affected the practice of teaching vocabulary through different strategies were treated under this section respectively.

### Analysis of Data Obtained through Interview Practices of vocabulary teaching strategies English teachers' practice during EFL classes.

There were thirteen teachers who participated in detailed interview. Even if they agreed on the importance of practicing different strategies in vocabulary teaching, the researcher did not observe them while they practiced different strategies effectively in their language classes during classroom observation. Thus, the analysis of data gathered through interview has not shown consistent results with findings of the questionnaire and observation. For example, when answering the first interview item, almost all teachers not only agreed on the importance of practicing vocabulary teaching strategies, but also claimed that

they practiced these strategies in their English classes. But this was not supported by the class room observation.

Therefore, when the interview was conducted with the teachers, it was examined how they practiced vocabulary teaching strategies in line with the given item. Regarding item A<sub>1</sub>, “Do you think that practicing different vocabulary teaching strategies are very important to enhance students’ vocabulary use? If yes, to what extent? If not, why?” Almost all of them agreed on the importance of using different strategies in vocabulary teaching. But they didn’t practice different strategies in the classroom during vocabulary instruction. When asked the reasons for not applying, they explained that they do not have adequate materials like dictionary and training on vocabulary teaching strategies so as to practice these strategies in EFL classes and to equip their students with vocabulary knowledge.

In line with this idea, they were asked “to which one of the strategies they give priority most of the time during vocabulary instruction?” Most of them reported as they give priority for contextual strategy for it is convenient to practice in the class.

According to their response, they said that practicing contextual strategy is helpful for students and for teachers since they can practice it from their experiences and it is easy to practice in the class. Because it can be used through different sentences in order to indicate different meanings of one word in a sentence in which the teacher provide students different sentences according to its suitability. The rest teachers gave priority to cooperative strategy because this strategy gives more chance of practicing and thereby retains more words.

Regarding teachers experiences of planning to use different vocabulary teaching strategies, most of the respondents replied that they plan to give vocabulary lesson that contain different vocabulary teaching strategies through integrating other language skills and practice them in the classes usually. But this was found inconsistent with the actual classroom observation because the teachers were not found when they attempted practice strategies in vocabulary teaching with integration of other language skills according their intention.

### Analysis of Data Obtained through Questionnaire

#### Teachers’ experiences of practicing vocabulary teaching strategies

Practices of Vocabulary Teaching Strategies.	Always		Usually		Some times		Rarely		Never		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
6. How often do you practice self selection strategies to convey the meaning of words during vocabulary teaching?	2	15.4	3	23.1	3	23.1	5	38.5	-	-	13	100.0
7. When you teach a vocabulary, how often do you practice task-based teaching strategy in your language classes?	2	15.4	1	7.7	4	30.8	6	46.2	-	-	13	100.0
8. How often do you give opportunities to your students to communicate with you and with their peers in English to develop their vocabulary?	3	23.1	2	15.4	3	23.1	5	38.5	-	-	13	100.0
9. Since there is no one a best strategy of teaching vocabulary, how much you try to practice different strategies according to their suitability?	-	-	3	23.1	4	30.8	6	46.2	-	-	13	100.0
10. To what extent you practice cooperative teaching – learning strategy to attract students’ attention towards the vocabulary lesson?	1	7.7	2	15.5	4	30.8	6	46.2	-	-	13	100.0
11. To what extent you teach to students so as to help them figure out the meanings of unknown words on their own through context?	2	15.4	6	46.2	4	30.8	1	7.7	-	-	13	100.0

12. In teaching vocabulary, how often do you focus on collocation strategies which enable students to develop their vocabulary use?	2	15.4	3	23.1	3	23.1	5	38.5	-	-	13	100.0
13. During your English class, how often do you practice task-based vocabulary teaching strategy to enhance your students' vocabulary knowledge through different tasks?	2	15.5	2	15.4	5	38.5	4	30.8	-	-	13	100.0
14. How often do you use definitional context clue to convey the meaning of words during vocabulary teaching?	1	7.7	6	46.2	4	30.8	2	15.5	-	-	13	100.0
15. During English class, how often do you practices types of contextual clues to familiarize you with unfamiliar words?	1	7.7	6	46.2	4	30.8	2	15.5	-	-	13	100.0
16. Since students should know the correct meaning of a word, how often do you facilitate them to practice meaning in a group with their partners to consolidate the meanings?	1	7.7	2	15.5	4	30.8	6	46.2	-	-	13	100.0

The Vocabulary Self-Selection strategy (VSS) is an interactive-learning instructional strategy that promotes word consciousness, as students are actively engaged in identifying important words from their reading to share with members of their class(Haggard, 1986). In this regard, item Q6 in Table 4.2.3 asked if the teachers practiced self selection strategy vocabulary teaching to convey the meaning of words during their English classes. Accordingly, while 2(15.4%) of the respondents practiced self selection strategy always during vocabulary instruction. Whereas 3(23.1%) of them said that they usually and sometimes did so respectively. But 5(38.5%) of the respondents said that they did practice self selection rarely. This is in line with the researcher's actual class observation. During the observation sessions, the teachers were not practicing the self selection strategy to develop their students' vocabulary use.

In replying to item 7 almost half of the respondents 6(46.2%) confirmed that they rarely practiced self selection vocabulary teaching strategy and 4(30.8%) of them practiced this strategy sometimes. Whereas 2(15.4%), and 1(7.7%) of the respondents answered that they always and sometimes did so respectively.

To sum up, according to Table 4.2.3, above, for item 6 and 7 respectively seem to indicate that the respondents in the English Department of Kellem Secondary School usually did not practice self selection vocabulary teaching strategy. In light of this, self selection strategy was not practiced frequently during vocabulary lesson. Even if learners do not have enough knowledge of the language structures, an adequate knowledge of vocabulary helps them to maintain a certain degree of communication (Wallace, 1982). Therefore, regarding classroom communication under item 8, 3(23.1%) of the respondents confirmed that they practiced to offer their students to practice

communicative strategy for maximizing communication opportunities always and sometimes respectively. But this is inconsistent with what the present researcher observed in the classrooms since most of the teacher didn't practice to offer their students to communicate with their teacher or their peers in the classroom. Whereas 2(15.5%) and 5(38.5%) of the respondents said that they practiced communicative strategy in vocabulary teaching usually and rarely respectively. Class room observation on the other hand proved that only 5(38.5%) of the teachers practiced this strategy in the classroom.

As far as practicing different types of vocabulary teaching strategies according to their suitability is concerned (item 9), while almost half of the respondents 6(46.2%) confirmed that they practiced rarely. Whereas (23.1%) and 4(30.8%) of the respondents replied that they practiced usually and sometimes respectively. however, during classroom observations, almost more than half of the teachers were observed rushing from one activity to another without paying attention to different strategies.

In the same table item 10 and 16 asked if the teachers organized students into different groupings when they taught vocabulary. Accordingly, 1(7.7%) and 2(15.5%) of the respondents in both items (Items 10 and 16) reported that they always and usually organized students into different groupings when they taught vocabulary respectively, whereas in both items 4(30.8%) and 6(46.2%) of them said that they sometimes and rarely practice cooperative strategy. This confirmed that, during the observation sessions, almost more than half of the teachers were not seen effectively organizing the students into different groupings – whole class organization was the dominant one. This implies the importance of obeying Atkins *et al.* (1996) who recommend organizing students in small groups and in whole class during vocabulary teaching/learning.

Words in context increase the chances of learners appreciating not only their meaning but their typical environments, such as their associated collocations or grammatical structures (Thornbury, 2002). Students learn from context by making connections between the new word and the text in which it appears. Consequently, 2(15.5%),6(46.2%) and 4(30.8%) of the respondents reported that they always, usually and sometimes practiced context clues so as to help the students to figure out the meaning of unfamiliar words respectively. This was supported during the actual classroom observation which indicated almost all teacher practiced context clues to teach vocabulary in EFL classes. Whereas 1(7.7%) of the respondent replied that she/he did it rarely.

In Table4.2.3, item 12, 2(15.5%) confirmed that respondents always practiced how words go together to enhance students vocabulary use; while 3(23.1%) of them answered that they usually and sometimes did so. Whereas 5(38.5%) of the respondents replied that they practiced collocation strategy rarely. The mean value of item 12 (3.15) further shows that the respondents sometimes practiced this strategy to encourage their students to understand how to use words according to their collocation. This implies the importance of obeying Jaén(2007) who recommended collocations are very important part of second language vocabulary teaching.

Item 13 in Table 4.2.3 was designed to ask if the teachers give tasks to the students so that they can practice two or more new words at a time. In replying to this item, while two of the respondents 2(15.5%) indicated that they always and usually give tasks to the students so that they practice unfamiliar words, 5(38.5%) and 4(30.8%) of the respondents replied that they practiced task based vocabulary instruction sometimes and rarely respectively.

Context clues are indicators of the meaning of a word. Such clues may be in the sentence that contains the word or somewhere else in the text within close proximity (Stahl, 1999). Consequently, practicing different types of context clues during vocabulary teaching which is used to highlight textual clues that lead to the meaning of the target word. This will enhance students' capability to recognize textual clues. Clues include synonyms, definitions, antonyms, contrasts, and examples. In line with this, item 14 and 15 asked whether the teachers practiced or not definitional and different types of context clues when they taught vocabulary. Thus, 1(7.7%) and 2(15.5%) of the respondents answered that they practiced context clues always and rarely respectively. Whereas, 6(46.2%) and 4(30.8%) of the respondents replied that they practiced definitional clues and other types of context clues usually and some times during vocabulary instruction in EFL classes correspondingly so.

**The frequency of practicing vocabulary teaching strategies practiced students' English teacher during English classes.**

Practices of vocabulary teaching strategy	Always		Usually		Sometim es		Rarely		Never		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
III <sub>6</sub> . How often does your English teacher practice self selection strategies during vocabulary teaching to enhance your vocabulary self selection?	12	13.3	19	21.1	26	28.9	30	33.3	3	3.3	90	100.0
III <sub>7</sub> . When your teacher teaches a vocabulary, how often does he practice task-based teaching strategy in the language classes?	13	14.4	19	21.1	26	28.9	32	35.6	-	-	90	100.0
III <sub>8</sub> . How often does your teacher give you opportunities to communicate with him/her and with your peers in English to develop your vocabulary?	12	13.3	19	21.1	27	30.0	32	35.6	-	-	90	100.0
III <sub>9</sub> . Since there is no one a best strategy of teaching vocabulary, how much your teacher tries to practice different strategies according to their suitability?	15	16.7	19	21.1	25	27.8	31	34.4	-	-	90	100.0
III <sub>10</sub> . To what extent your teacher offers you to practice cooperative learning strategy to attract your attention towards the vocabulary lesson?	15	16.7	19	21.1	25	27	31	34	-	-	90	100.
III <sub>11</sub> . To what extent your teacher teaches you so as to help you figure out the meanings of unknown words on your own through context?	22	24.4	31	34.4	24	26.7	13	14.4	-	-	90	100.0

III <sub>12</sub> . In teaching vocabulary, how often does your teacher focus on collocation strategies which enable you to develop your vocabulary use?	8	8.9	17	18.9	32	35.6	33	36.7	-	-	90	100.0
III <sub>13</sub> . During your English class, how often does your teacher facilitate to practice communicative vocabulary learning strategy to enhance your vocabulary knowledge?	11	12.2	18	20.0	28	31.1	33	36.7	-	-	90	100.0
III <sub>14</sub> . How often does your teacher use definitional context clue to convey the meaning of words during vocabulary teaching?	13	14.4	30	33.3	25	27.8	22	24.4	-	-	90	100.0
III <sub>15</sub> . During English class, how often do your teacher practices types of contextual clues to familiarize you with unfamiliar words?	18	20.0	31	34.4	24	26.7	17	18.9	-	-	90	100.0
III <sub>16</sub> . Since you need to know the correct meaning of a word, how often does your teacher facilitate you to practice meaning in a group with your partners to consolidate the meanings?	11	12.2	21	23.3	25	27.8	33	36.7	-	-	90	100.0

In vocabulary self selection strategy, teachers engage students in the process of vocabulary self-selection. Students work in small groups of three to five, and they read a short passage from the book with the teacher.

They are guided by the teacher to identify a word they wish to select. The teacher demonstrates how to use context and other resources to figure out the meaning of the word (Haggard, 1986).

As can be seen from table 4.2.3, the percentage for item III<sub>16</sub> (36.7%) is titled to words rarely. This could indicate that the English teachers in Kellem Secondary School do not always/ usually practice self selection strategy to engage students so that they do not get exposed to practice this strategy from a short passage or from the book with the teacher. The students were also asked if their teachers practiced task based vocabulary instruction to encourage them so that they ask questions and express their ideas freely on item III<sub>7</sub>, item III<sub>8</sub> and item III<sub>13</sub> extracted whether or not the teachers gave opportunities to create communicative learning process to the students so that they take responsibility to create a dialogue and communicate with their teacher and their peers for the improvement of their vocabulary use when they learn vocabulary through task based and communicative vocabulary instruction. The percentage for items III<sub>7</sub>, III<sub>8</sub> and III<sub>13</sub> respectively which incline towards rarely; and this would seem to suggest that the teachers do not usually or sometimes play their executive roles which are entertained by these items. Similarly, this is consistent with what the present researcher observed in the classrooms during vocabulary instruction. This is because almost all the teachers were not seen effectively playing their executive roles (as advisor, monitor, organizer, facilitator and so on) in the classrooms. This is why through tasks; teachers can have a number of options for enhancing attention to teach vocabulary. One of such options is to allow learners to work cooperatively to make sense of unfamiliar vocabulary via tasks. Regarding communicative vocabulary instruction, the teacher's role in Communicative

Language Teaching especially vocabulary is mainly acting as a facilitator for classroom activities as well as home take assignments to make learners engage in groups or pairs work. Instruction plays an essential role in passing messages and thoughts to learners. Teachers are expected to full fill what is required from them for the benefit of learners.

Item III<sub>9</sub> was designed to obtain information from students if their teacher provides them with different vocabulary teaching strategies in which students are confronted to enhance their vocabulary knowledge and develop their understanding about vocabulary use and then they practice two or more strategies at a time. This also indicates that the English teachers rarely practice different vocabulary teaching strategies as resources of helping students practice vocabulary use. In responding to teachers interview, item B<sub>2</sub> (See Appendix I), however, the teachers gave an opposite response to this. That is, teachers were asked to what extent they plan vocabulary lesson that contain different vocabulary teaching strategies and practice them so that students could take responsibilities for their own work and practice two or more strategies at a time, their answer shows that they usually use contextual strategy to help their students practice figure out the meaning of unfamiliar words. Similarly, during the entire classroom observations made, few of the teachers rarely tried to practice various vocabulary teaching strategies according to their suitability.

As shown in Table 4.3.3 above, the percentage of item III<sub>10</sub>(34%) falls in the rarely range; and this would show that the teachers do not always and/or usually try to practice cooperative strategy to organize students into pair or group in order to engage in the tasks and arouse their interest when they teach vocabulary. The above table also shows that the percentage of item III<sub>16</sub> (36.7%) inclined towards 'rarely'. From this, it could be concluded that teachers do not give due attention to make use of group/ cooperative instruction when they teach vocabulary. The classroom observation result also confirmed this reality.

The students were also asked if their teachers encouraged them so that they figure out the meaning of unfamiliar words through definitional context clues or through different types of context clues (item III<sub>11</sub>, III<sub>14</sub> and item III<sub>15</sub>) elicited whether or not the teachers gave useful text to present them in context and students are more likely to deduce meaning from a context. Divorcing words from their surroundings decreases the likelihood of comprehension and retention and it was emphasized that new vocabulary should only be met in sentences and meaningful contexts (Richards and Rodgers 2001). So, setting a good context which is interesting, plausible, vivid and has relevance to the lives of the learners, is an essential prerequisite for vocabulary teaching as it helps in both engaging the attention of the learners and naturally generating the target vocabulary. The percentage for items III<sub>11</sub>, and III<sub>15</sub> are 34.4%, and 34.4% respectively which incline towards 'rarely' and the percentage of III<sub>14</sub> is 33.3 % this would seem to suggest that the teachers attempted to practice this strategy more than the other strategies to enhance the students strategy to understand the meaning of unfamiliar words and develop their ability to practice how to

guess the meaning of new words through these type of contextual clues. Likewise, this is very consistent with what the present researcher observed in the classrooms.

On top of this, in reacting to teachers' interview, item A<sub>2</sub> (See Appendix I) teachers were asked when they teach vocabulary, to which one of the strategies they give priority most of the time so that they could practice them and use them so as to develop their vocabulary knowledge. Thus, their answer shows that they usually practice context strategy as a strategy of helping students practice vocabulary learning strategies.

**Analysis of Data Obtained through Observation**

The analysis and presentation of the data collected through classroom observation is presented below. To fulfil the purpose of the observation, the selected teachers were observed. The data based on the requirement of the classroom checklist (see appendix IV) were collected and the observation was conducted by the researcher. Thus the observation result was presented under here.

**Teachers' role during vocabulary instruction**

Teacher's role during vocabulary instruction	Yes		No		Total	
	F	%	F	%	F	%
I <sub>1</sub> . The teacher introduces the students know the objectives of the lesson so that the students direct their attention to vocabulary instruction.	6	46.2	7	53.8	13	100
I <sub>2</sub> . The teacher lets the students know the significance of vocabulary learning to their real-life communication	5	38.5	8	61.5	13	100
I <sub>3</sub> . The teacher teaches vocabulary consciously to arouse students' attention towards to vocabulary instruction.	4	30.8	9	69.2	13	100
I <sub>4</sub> . At the end of the class, does the teacher give home take assignment that invite students to practice vocabulary self selection?	13	100	0	0	13	100

As depicted in Table 4.3 .1the data obtained from classroom observation revealed that 9(69.2%) of the teachers introduced the objective of the lesson so that the students direct their attention to the lesson; whereas, 4(30.8%) of teachers didn't introduce the lesson and they observed while they were presenting the lesson by letting the students see from their text and read the words and try to guess the meaning of the words. According to Nation (2001) the teacher may draw students' attention on a particular word by writing the new words on the blackboard; the learner may focus on the meaning of a word by providing a definition, a synonym or L1 equivalent.

Regarding letting the students know the significances of vocabulary in a real life communication, 5(38.5) of them were interested in letting the students to understand the importance of

using vocabulary in real life communication. While more than half of them which means 8(61.5%) of the teachers were not interested in creating an opportunity for communication in line with this, students were very passively asking and answering questions in English. Thus, what the teachers should do is to enlarge readers' situation knowledge, arouse their communicative desire to attain the communicative aim ( Yiwei WU,2009). This indicates that the teachers did not practice different vocabulary teaching strategies consciously to arouse students' attention towards vocabulary instruction. In case of giving home take assignment, all teachers gave them at the end of the lesson.

**Teachers’ practice of vocabulary teaching strategies in EFL classes**

Items no	Yes		No		Total	
	F	%	F	%	F	%
II <sub>1</sub> . Does the teacher present the words through context?	10	77.0	3	23.1	13	100.0
II <sub>2</sub> . Does the teacher employ self selection vocabulary teaching strategies during vocabulary instruction?	4	30.8	9	69.2	13	100.0
II <sub>3</sub> . Does the teacher provide task based instruction to utilize vocabulary usage?	5	38.5	8	61.5	13	100.0
II <sub>4</sub> . Does the teacher create conducive situation for students to communicate with their teacher and their peers to enhance students’ vocabulary knowledge?	3	23.1	10	77.0	13	100.0
II <sub>5</sub> . Does the teacher create sentences containing the new words in different sentences to teach words in different types of context clues? (Like explanation, definition, synonyms etc)	10	77.0	3	23.1	13	100.0
II <sub>6</sub> . Does the teacher teach vocabulary through collocation?	3	23.1	10	77.0	13	100.0
II <sub>7</sub> . Does the teacher employ Cooperative vocabulary instruction?	6	46.2	7	53.8	13	100.0

In Table 4.4.2 above, the classroom observation result indicates that the majority of the strategies expected to be practiced by the teachers were not observed except contextual strategies and types of contextual clues. For instance, under item II<sub>1</sub> and item II<sub>5</sub>, 10(77.0%) of the teachers were observed that they practiced contextual strategy.

Next to this, 6(46.2%) of them employed cooperative strategy in the class. In the interview conducted with the teachers, some of the teachers confirmed that practicing all the activities in classroom is difficult. This indicates that the teachers haven’t had access opportunity to practice these strategies according to their suitability during vocabulary instruction. The reasons for not applying the strategies mentioned in Table 4.4.2 may be lack of training on vocabulary teaching strategies which has a consistency with the questionnaire item IV<sub>II</sub> and IV<sub>III</sub> (see appendix II). Regarding students participation during vocabulary instruction, the students were not observed to take part actively in asking questions in English language. In connection to this, during cooperative or group work, they preferred to use their mother tongue (Afan Oromo) rather than practicing English language. This is also another problem the researcher observed in the class.

Generally, in all observed classes, teachers were usually interested in using contextual strategy of teaching vocabulary. For example, teachers frequently used definition, synonyms and examples types of context clues (77%) of them. They also often practice cooperative teaching strategy (46.2%) without paying attention to the use/ practice of the target language. Even if they did not totally ignore the rest strategies; they practiced in a very limited manner. In brief, it is worth-noting is that teachers used very limited types of vocabulary teaching strategies except contextual strategy and cooperative strategy. In line with this,

they used translation to teach vocabulary more often than the other strategies in the class. Of course, there is nothing wrong in using translation to teach vocabulary. Translation is really a useful strategy, especially when the students’ proficiency is low. The question is that it should not be overused. This could be the main reason for the students’ less retention of words and vocabulary knowledge. Furthermore, this discrepancy on the focus of vocabulary teaching strategy and learning seems to have resulted not only lack of adequate training of it but also it resulted in their different views on the methods of vocabulary teaching strategies.

**IV. CONCLUSIONS AND RECOMMENDATIONS**

Based on the major findings, the following conclusions and recommendations are forwarded by the researcher.

**V. CONCLUSIONS**

Based on the major findings of the study, the following conclusions are drawn.

The teachers hardly practice different vocabulary teaching strategies during vocabulary instruction. From this, we may realize that the teachers do not persistently practice/ use these strategies during vocabulary instruction.

The teachers frequently used context strategy and whole class organization at the expense of pair and/or group organizations when they taught vocabulary in EFL classes. More importantly, strategies such as vocabulary self selection strategy, task based strategy; cooperative strategy and communicative strategy that promote learners’ knowledge of vocabularies in the

classroom and/or outside the classroom were rarely practiced during vocabulary lessons by the sample teachers. As a result, students would be unable to develop and make use of the previously learned vocabulary items in their effort of using the language for actual communication.

In conclusion, it is obvious that different teachers use different strategies in the classrooms. Currently vocabulary teaching practices through different strategies at Kellem high school, however, practice a very limited number of vocabularies teaching strategies appeared to be given a secondary importance by the sample teachers. So teachers were less concerned with the practice of vocabulary teaching strategies compared to other aspects of vocabulary teaching and they focused on contextual strategy which was the most dominantly practiced strategy compared to the other vocabulary teaching strategies. For this reason, students were less interested in learning vocabulary through other strategies which were believed to be fostering better vocabulary knowledge. Since no varieties of vocabulary teaching strategies were practiced at Kellem Secondary School in EFL classes, vocabulary teaching through different strategies has got less attention.

#### VI. RECOMMENDATIONS

Based upon the findings and the conclusions drawn from the study, the following recommendations could be made:

❖ It would be advisable for the teachers to practice vocabulary teaching strategies and implement them as much as possible when they teach vocabulary in EFL classes, because vocabulary teaching is one of the most important components of any language class. The main reason is the fact that it is a medium, which carries meaning; learning to understand and express the meaning is what counts in learning languages (McCarthy 1990). English language teachers should develop favorable tendency to the primacy of vocabulary in the process of language teaching and learning so that they will be able to consider vocabulary teaching strategies as the major component of their language lessons.

- ❖ The students need to be aware of the advantages of vocabulary learning through different strategies to their daily life so that they become motivated and thereby actively play their roles in the using and practicing of these strategies in teaching and learning process. Students, on the other hand, must promote the sense of autonomous vocabulary learning by practicing intelligent guessing from context and by using vocabulary self collection strategy.
- ❖ Creating meaningful learning opportunities in and out of the school is very important for learners to make use of the language. Establishing English club and declaring one day as an English day help learners to use the language in school.

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# Antimicrobial activity of Endophytes from aerial and non aerial parts of *Calotropis procera* against Pathogenic microbes

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**Abstract:** Endophytes are the microbes which are invading in the host plant tissues and are believed to produce the similar metabolites as that of the plant tissue. The present study was performed for isolation, identification and determination of endophytes from leaves, stem and roots of *Calotropis procera* (Aak/Madar) antimicrobial potential against the dreadful pathogens and drug resistant strains. It is already reported that, *Calotropis procera* plays an important role in improving soil fertility and improved soil water holding capacity. The root bark is febrifuge, anti-helminthic, depurative, expectorant, and laxative. The powdered root promotes gastric secretions and useful in asthma, bronchitis, and dyspepsia. Flowers are useful in asthma, catarrh, anorexia, inflammations and tumours. In the present investigation, after the surface sterilization of leaves, stems and roots of the plant, different bacterial and fungal endophytes were isolated on Luria-Bertani (LB) and Potato dextrose agar (PDA) medium respectively. It was found that, 05, 06 and 03 fungal endophytic isolates were obtained from leaves, stems and roots respectively out of which 03 fungi were common in all the three. The dominant endophytic fungi were identified as *Aspergillus niger*, *Rhizopus stolonifer*, *Phoma hedericola*, *Curvularia pallaescens* and *Penicillium chrysogenum* and *Fusarium oxysporum*. Total of 10, 05 and 05 bacterial endophytes were isolated from leaves, stems and roots respectively. The dominant endophytic bacteria were identified as Gram positive bacilli (CPGPB), gram positive cocci (CPGPC) and gram negative bacilli (CPGNB). The antimicrobial activity of dominant endophyteic fraction viz. *Phoma hedericola* (PH), *Curvularia pallaescens* (CP), *Penicillium chrysogenum* (PC'), CPGPB, CPGPC and CPGNB were checked against test bacterial cultures viz. *Bacillus subtilis*, *Bacillus licheniformis*, *Micrococcus luteus* and *Pseudomonas aeruginosa*. The results were found to be very significant and surprising as all these endophytic solvent fractions showed potent antimicrobial activity against the test organisms.

**Key words:** *Calotropis procera*, Endophytes, antimicrobial activity, pathogens.

## I. INTRODUCTION

Endophytes are those microorganisms that inhabit interior of plants especially leaves, stems, roots shows no apparent harm to host. These endophytes are diverse group of microbes which may be bacteria, fungi, actinomycetes etc [1-3]. It is meant that there is a great diversity of population of microbes residing in the tissues of most of the medicinal plants and thus are able to produce the similar kind of secondary metabolites as is produced by the specific plant tissue. Thus there is a need to explore the biodiversity and medical importance of such microbes residing in the plant tissues. To date, only a few plants have been broadly investigated for their endophytic biodiversity and their probable to produce bioactive secondary metabolites. Endophytic fungi are of biotechnological interest due to their potential as sources of secondary metabolites have proven useful for novel drug discovery [4]. Each plant has been reported to harbor one or more endophytes [5, 6]. Plant based natural constituents can be derived from any aerial or non aerial parts of the plant which may cause extinction of endangered plant species thus, there is a need to isolate and investigate the biodiversity of endophytes which can also produce similar kind of secondary metabolites as the part of the plant contains where the specific endophytic bacteria or fungus resides.

## II. MATERIALS AND METHODS

**Surface sterilization of plant tissues and Isolation of endophytes**

Further the tissues of the plant were soaked in 70% alcohol for few seconds or in 0.5-3.5% sodium hypochlorite for 1-2 minutes followed by rinses in sterile double distilled water before placing it on a LB medium for isolation of endophytic bacteria [7]. For isolation of fungal endophytes surface sterilization of tissue requires 70% ethanol for 1-3 minutes, aqueous sodium hypochlorite (4% available chlorine) for 3-5 minutes again rinse with 70% ethanol 2-10 seconds and final rinse with double distilled water and drying in laminar air flow. Sterile knife blade was required to remove outer tissues from sample and to excise inner tissues. The PDA plates were kept for about 5-6 days for observation of growth of any fungal endophytes. All the plates were incubated at 28°C to promote the growth of endophytes and were regularly monitored for any microbial growth [8]. On observing the microbial growth, sub-culturing was done. Each endophytic culture were checked for purity and transferred to freshly prepared PDA plate. Appropriate controls will also be maintained in which no plant tissues were inoculated. The bacterial and fungal endophytes isolated were identified.

### **Maintenance of Endophytes for Identification and Future Use**

The purified endophytic isolates were transferred separately to LB/PDA slants and broths depending on the case for bacterial and fungal endophytes respectively and accessioned accordingly depending upon the plant parts from which they have been isolated. Finally all the purified endophytes were maintained at 4°C till further used. Different biochemical tests were done for identification of bacterial and fungal endophytes. The bacterial isolates were tested for their morphological and biochemical characteristics (catalase enzyme activity). Gram stains were performed to determine the characteristics of the cell wall, cell shape and the arrangement of cells. The morphology of the endophytic bacterial strains was observed on slides under a microscope. For staining, 15 µL of a bacterial culture that is grown in nutrient broth overnight at room temperature with shaking at 150 rpm were heat-fixed onto a slide and then stained. The fungal slides if isolated were stained with lactophenol. The structures were observed using a photomicroscope. The samples were then compared to other samples reported in the literature [9-11].

### **Production of Secondary metabolites**

LB broth and Potato Dextrose broth were prepared and autoclaved. Endophytic bacterial and fungal cultures were inoculated in the medium separately within the flasks. Flasks were then incubated at 28°C for 10-14 days in shaker. After incubation, extraction was done with different solvents (Chloroform, Ethyl acetate). The organic phase were collected and kept for drying at 37°C. The dry weight of the extract was determined.

### **Determination of Antimicrobial activity**

#### **Culture Media**

For antibacterial test, Soyabean Casein Digest agar/broth was used.

#### **Inoculum**

The bacteria viz. *Bacillus subtilis*, *Bacillus licheniformis*, *Micrococcus luteus* and *Pseudomonas aeruginosa* were inoculated into Soyabean Casein Digest broth and incubated at 37°C for 18 h and suspension were checked to provide approximately, 10<sup>5</sup> CFU/ml.

#### **Determination of diameter of zone of inhibition by well diffusion method**

The agar well diffusion method was modified [12]. Soyabean Casein Digest agar medium (SCDM) was used for bacterial cultures. The culture medium was inoculated with the bacteria separately suspended in nutrient broth. A total of 8 mm diameter wells were punched into the agar and filled with secondary metabolites at 200 mg/ml. Standard antibiotic (Erythromycin, 1 mg/ml) was simultaneously used as the positive control. The plates were incubated at 37°C for 18 h. The antibacterial activity was evaluated by measuring the diameter of zone of inhibition observed. The procedure for assaying antibacterial activity was performed in triplicates to confirm the readings of diameter of zone of inhibition observed for each of the test organism.

## **III. RESULTS AND DISCUSSION**

In the present investigation, after the surface sterilization of leaves, stems and roots of the plant, different bacterial and fungal endophytes were isolated on Luria-Bertani (LB) and Potato dextrose agar (PDA) medium respectively. It was found that, 05, 06 and 03 fungal endophytic isolates were obtained from leaves, stems and roots respectively out of which 03 fungi were common in all the

three. The dominant endophytic fungi were identified as *Aspergillus niger*, *Rhizopus stolonifer*, *Phoma hedericola*, *Curvularia pallaescens* and *Penicillium chrysogenum* and *Fusarium oxysporum*. Total of 10, 05 and 05 bacterial endophytes were isolated from leaves, stems and roots respectively. The dominant endophytic bacteria were identified as Gram positive bacilli (CPGPB), gram positive cocci (CPGPC) and gram negative bacilli (CPGNB). The antimicrobial activity of dominant endophytes fractions viz. *Phoma hedericola* (PH), *Curvularia pallaescens* (CP), *Penicillium chrysogenum* (PC'), CPGPB, CPGPC and CPGNB were checked against test bacterial cultures viz. *Bacillus subtilis*, *Bacillus licheniformis*, *Micrococcus luteus* and *Pseudomonas aeruginosa*. The results were found to be very significant and surprising as all these endophytic solvent fractions showed potent antimicrobial activity against the test organisms. The results are shown in **Table 1** and **Figures 1-7**. Previous studies reported the endophytic fungi from *Calotropis procera* [13]. Antibacterial activity of twenty different endophytic fungi isolated from *Calotropis procera* were recorded [14].

#### IV. CONCLUSION

The present study suggests that endophytic isolates had a great biodiversity in *Calotropis procera*. These endophytes are potential source of antimicrobial metabolites. The study may thus lead to the isolation and identification of significant antimicrobial molecule (s) from such endophytes. Further identification of such molecules is required to formulate some novel/alternate antimicrobial agents against such dreadful pathogens.

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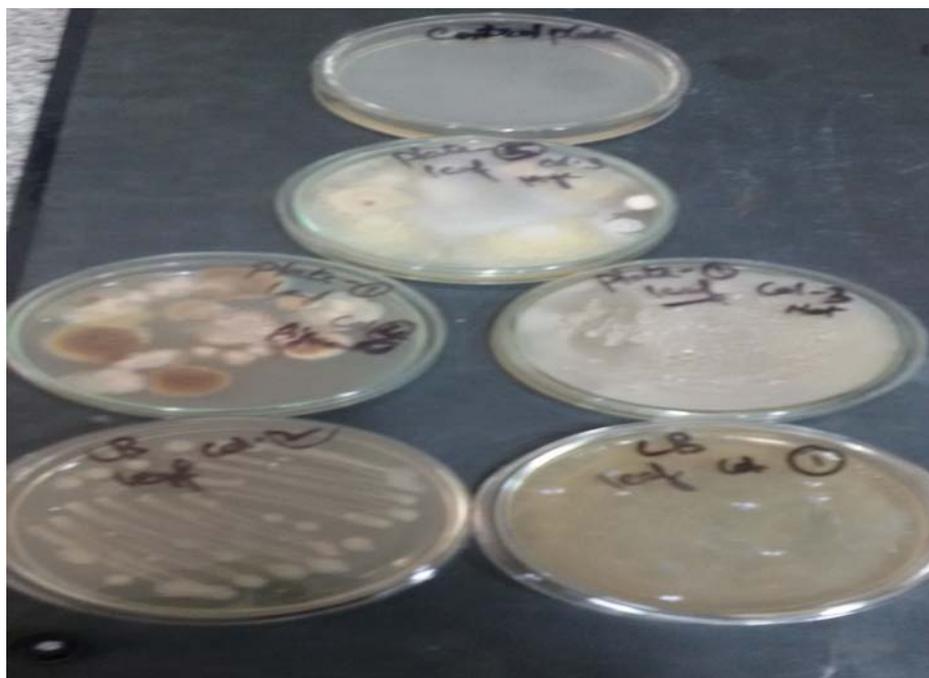
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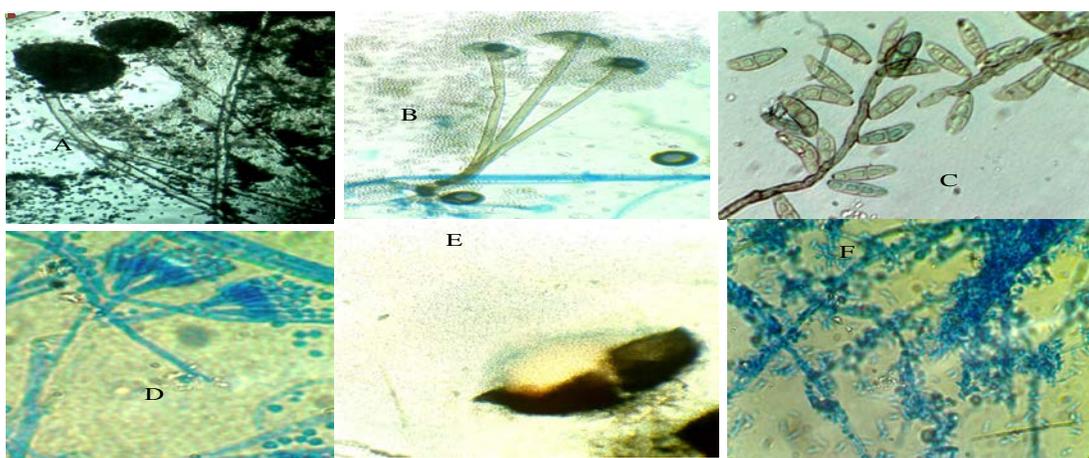
**Figure 1:** Inoculation of surface sterilized parts of *Calotropis procera* on LB and PDA



**Figure 2:** Growth of bacterial and fungal endophytes in leaves, stems and roots of *Calotropis procera*

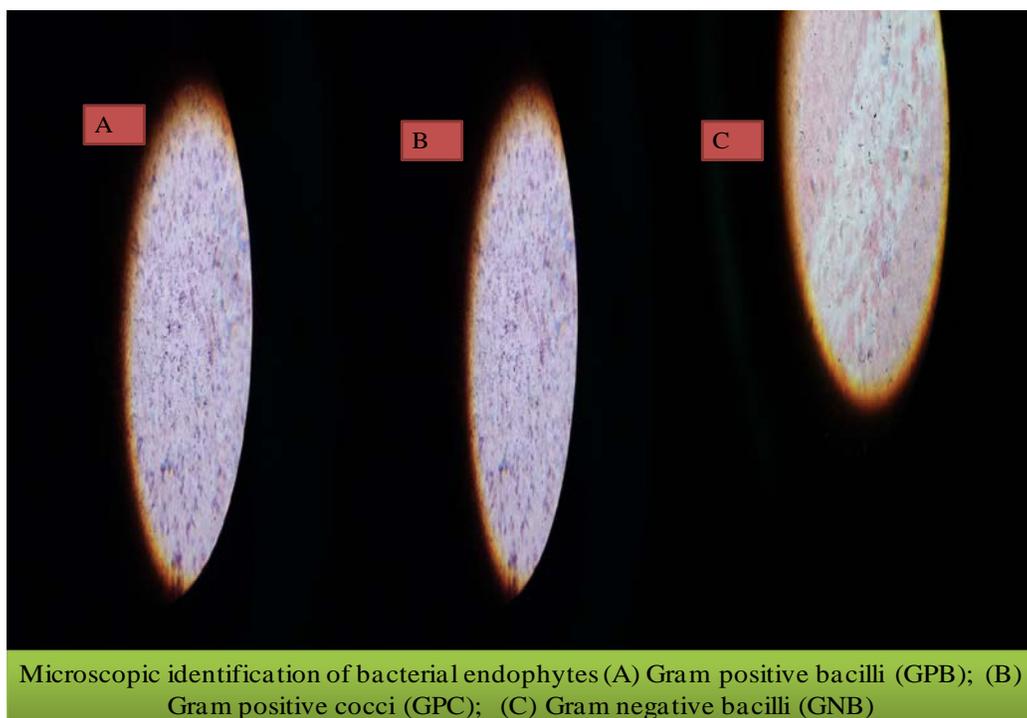


**Figure 3:** Isolation of pure cultures of bacterial and fungal endophytes on LB and PDA media



Microscopic identification of fungal endophytes (A) *Aspergillus niger*; (B) *Rhizopus stolonifer*; (C) *Curvularia pallaescens*; (D) *Penicillium chrysogenum*; (E) *Phoma hedericola*; (F) *Fusarium oxysporum*

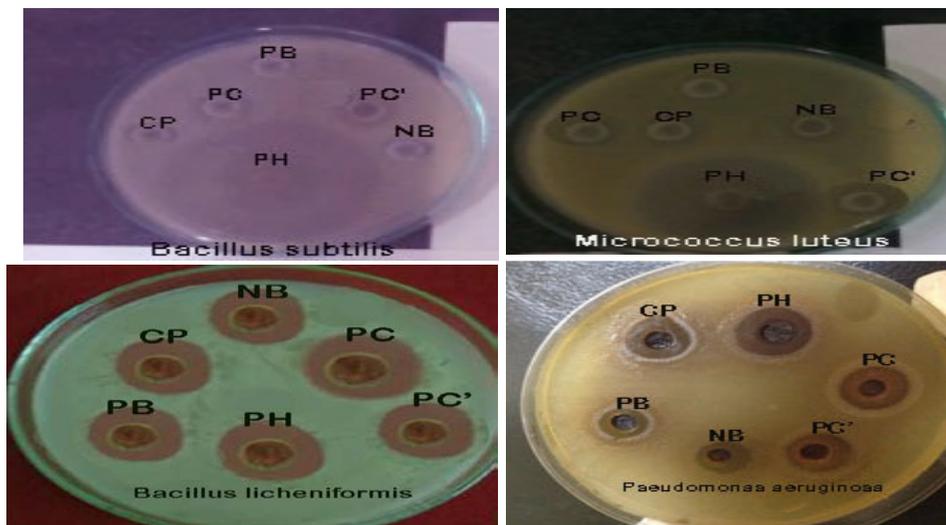
**Figure 4:** Microscopic taxonomical features of the fungal endophytes isolated



**Figure 5:** Microscopic images of the bacterial colonies observed after gram staining

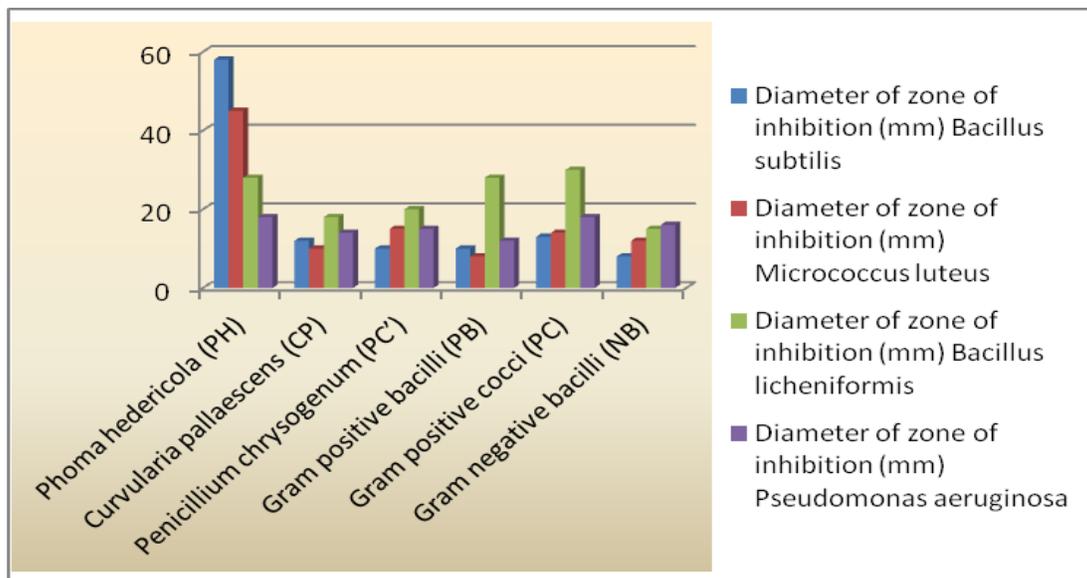
**Table 1:** Antimicrobial activity of the endophytic fractions/secondary metabolites against the pathogens

Endophytic fractions/Secondary metabolites	Diameter of zone of inhibition (mm)			
	<i>Bacillus subtilis</i>	<i>Micrococcus luteus</i>	<i>Bacillus licheniformis</i>	<i>Pseudomonas aeruginosa</i>
<i>Phoma hedericola</i> (PH)	58.0	45.0	28.0	18.0
<i>Curvularia pallaescens</i> (CP)	12.0	10.0	18.0	14.0
<i>Penicillium chrysogenum</i> (PC')	10.0	15.0	20.0	15.0
Gram positive bacilli (PB)	10.0	8.0	28.0	12.0
Gram positive cocci (PC)	13.0	14.0	30.0	18.0
Gram negative bacilli (NB)	8.0	12.0	15.0	16.0



\*Gram positive bacilli (PB); gram positive cocci (PC); gram negative bacilli (NB); *Phoma hedericola* (PH), *Curvularia pallaescens* (CP), *Penicillium chrysogenum* (PC')

**Figure 6:** Antimicrobial activity of the endophytic fractions



**Figure 7:** Graphical representation of the antimicrobial activity of the endophytic fractions/secondary metabolites

# Assessing the issues of Children's parents with autism spectrum disorders in Al-Najaf City

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**Abstract-** Autistic spectrum disorder (ASD) is a new unique disorder. It has qualitative impairments on child and many impacts extend to all family members and his community.

A cross-sectional study was included (80) parents had child with ASD enrolled in centers for ASD caring in Al-Najaf City. The study aimed to assess the parents issues, as well as, to find any significant relationship among severity of ASD and demographic characteristic of parents, child and impacts them.

Purposive sample used to select parents to participate in study according residence in Al-Najaf Province, enrolled their child in centers for autism and have at least one biological parents as a guardian on him.

A tool of study contain two main parts. First part included question related to demographic characteristics of parents and their child. Second part related to impacts on parents. As well as information about informants and copy from CARS scale to detect severity of ASD by staff of autism centers.

The results revealed (46.3%) of both the mothers and fathers shared to answer the questionnaire together and more (76%) of parents have good information about ASD and readiness to receive more information about it. More than (78%) of children have moderate to severe ASD. There is significant relation among severity of ASD, types of treatment used with child and degree of impacts on parents, but no significance between severity of ASD and parents health status.

The study concluded ASD have more impacts on parents when severity of it increased, closeness between parents increased after diagnosing their child with it. So it is recommended to establish special multidisciplinary plan among Ministries of Health, Education and Iraqi Ministry of Labor and Social Affairs to support and reduce the parents and their child impacts.

**Index Terms-** Assessing, Issues, Parent, Autism spectrum disorder.

## I. INTRODUCTION

Autistic spectrum disorder (ASD) is a new unique disorder. It has qualitative impairments on child and many impacts extend to all family members and his community.

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## INTRODUCTION

Autism spectrum disorder (ASD) is of the neurodevelopmental disorders, which onset during the developmental period and can be diagnosed before the child enters grade school and lasts throughout a person's life" (Jorgensen, 2008). When a child diagnosed with ASD in first time their parent feel sad, stress, depression, anxiety and denial (Chimeh et al., 2008). Solomon et al. (2004) mentioned the parents stress increases about their children and affected on their performance and health. In recent years, there are vast improvement in diagnostic criteria of ASD, social services, psycho-educational services (Bryson and Smith, 1998), heightened attention public in ASD (Howlin, 2005) and active roles for parents in treatment their children (Marcus et al., 2005). Early diagnosis for a child are poses many benefits for a child and their parents due to receive them for best services and more than a child late diagnosed with ASD (Attwood, 2007) and can established experiences the naturalistic educational for a child (Baker-Ericzén et al., 2005). Although early diagnosis of a child with ASD, parents might need counseling or other services support to alleviate emotional distress and stress (Hutton & Caron, 2005). ASD is characterized by impairments of personal, social, academic, or occupational functioning and has intellectual disabilities (intellectual developmental disorders) or without intellectual disabilities (DSM-5, 2013).

ASD includes autistic disorder, Asperger's syndrome, pervasive developmental disorder not otherwise specified (PDD-NOS) (Gurney et al., 2006), childhood disintegrative disorder and Rett's syndrome according to the new definition of ASD in the DSM-5, published in 2013. WHO defines ASD as "a range of conditions characterized by some degree of impaired social behavior, communication and language and a narrow range of interests and activities that are both unique to the individual and carried out repetitively" (www.who.int, in April 2017).

Estimate a prevalence of ASD in about 10-20 per 10,000 persons (Semple & Smyth, 2013) or in the United States estimate a prevalence of ASD about 1 per 68 according to report of Centers for Disease Control and Prevention (CDC) published in 2014, but in Iraq does not have official statistical for incidence of ASD.

Many of parents find difficulties to access services because the lack of information concerned of procedures to reach services and policy (Divan et al., 2012). The requirements of parents with children of ASD are different according to their level of education, gender and age of their children (Derguy et al., 2015), but there was no influence to the types of parents' occupation (Papageorgiou & Kalyva, 2010). Some studies revealed the parents faced problems when they needed to get information about their children's disorder and appropriate support by professionals (Papageorgiou and Kalyva, 2010) and some parents are ready to participate in activities and training programs of ASD management. Most of ASD programs management are poor to collaboration and coordination between professionals and parents (Ahmadi et al., 2011; Derguy et al., 2015). So that most mothers and fathers seek about alterations to restore parental confidence, share tips and experiences (Papageorgiou & Kalyva, 2010), they used effectively communication with their family and friends (Ahmadi et al., 2011).

There are large numbers of therapeutic options available now to improve functioning of children with ASD, so in study of Green et al., (2006) mentioned the survey of Autism Organization Worldwide Internet of 552 parents reported used at least one from 108 treatments of 111 listed for ASD (Brown, 2010). ASD has a permanent impacts not only on a child, but also on his family members (Gau et al., 2012). Parents often are not able to deal with the secondary symptoms of ASD such as eating problems, sleeping, stereotypies and behavioral disorders (Humphreys et al., 2014). Also a child may suffering from lack in social reciprocity, hinder learning, intelligence deficit and emotional sharing. Other dimensions to impact of ASD are related in social, financial, professional domains, physical and mental health of parents may deteriorate and experience of stress, anxiety, depression... etc. (Divan et al., 2012). On the other hand, ASD child and their parents are in more need to services and support from normally children or with other disorders (Kogan et al., 2005-2006). ASD disorder may lead to the social isolation to parents because of avoidance of stigma and had limited amount of time spent outside the family (Divan et al., 2012; Gray, 2001), as well as, effects on parents' health in physical, mental, emotional and in other life domains like in social relationship (in community, work or in home). Other issues related in parents have a child with ASD such as some problems related to effect ASD on a marital status, family impact and changes in family

relationship, environment, communication and function (Derguy et al., 2015; Gau et al., 2012), also number of hours spent (time) to care for a child and hours of work, the relationship with friends and community may altered in numerous trends, difficulties of family to access and getting support to their needs were related to ASD (Derguy et al., 2015), difficulties in access of services and traveling to treatment, money expenditure on services, care and treatment, stress and anxiety about future of his/her child and family (Brown, 2010); these impacts may be less with medical home (Kogan et al., 2005-2006). Weakness in provision of services system will increase the challenges on parents in economical and medical spheres which result negatively reflect on family members in general and child's disorder specifically (Derguy et al., 2015).

To reduce these impacts on parents, family and child by assist child to do daily living skills and courage parents to depend on formal and informal sources of supports (Hartely & Schultz, 2015).

This study is first research will which study the issues of parents who have children with ASD in Al-Najaf province. The researchers will study ASD for many reasons: Modern disorder and high prevalence and continuous increased numbers not only in Iraq, but in the world (CDC, 2014). Also, the parents of children with ASD are important part of community who have enough services and supports such as other diseases and disorders like heart centers, DM centers, institutes of mental retardation, deafness institutes,...etc. So that the study will aim to explore and identify the important issues of parents with children ASD and also, to identify the relationship between severity of ASD and the issues of parents who have a child with ASD and their demographic characteristics.

## Methodology

A cross-sectional study was included parents who had child with ASD enrolled in centers for ASD caring in the Holy Al-Najaf province. Instrument of study had two main parts in addition to a very important paragraph related to informant of the questionnaire because this tool used to self-reported by informant. Part one related with demographic characteristics of father, mother and their child who had ASD. Part two is related with the impacts of ASD on parents from Brown study (2010).

## Sample Size and Sampling Technique

Size of sample was included (80) parents had child with ASD. The parents were selected by a purposive sample technique which have criteria of study such as should live in or inclusion with Al-Najaf province boundaries, have a child with ASD age's between 3 to 12 years and enrolled in center of autism. The data collected from 28th Mars to 20th April 2017.

## Statistical Analysis

By using computer software SPSS v.17 and Microsoft Office Excel (2010) to analysis data and determine whether the study will achieve their goals or not. The researchers checked data void of mistakes and missing, then used computer software to analyze and extract the results.

## Results and Discussion

The value of Cronbach's Alpha for impact on parent scale in current study equal 0.896 acceptable in scientific research.

The dominant of informants are both fathers and mothers were shared to answer the questions of study tool (37), as shown in figure (1). Age of majority fathers and mothers who joined in the study between 31-50 years; range of fathers age between (22-64) years, with mean  $(38.39 \pm 7.975)$ . While the range of mothers age between (20-62) years, with mean  $(33.36 \pm 7.150)$  (table 2). Al-Najaf province occupies first rank in marriage rate in early age among other provinces (CSO, 2007a, 2007b; NCPP, 2012). This reflects the nature and traditions of Iraqi society in marriage of girls in early age (under 18 years). So that, (53.8%) of parents married from kindred and (96.3%) of them were still married although had a child with ASD; majority parents (95%) had (1-5) children, although (65%) of them had a child with ASD in order he is the first or second among his siblings. This is a good indicator for ASD which is not effective on relationship between them or reproduction status. It may be considered as a positive gain from ASD to strength and closeness of family (Hastings et al., 2002), as shown in table (1).

Majority of parents lived in urban region of Al-Najaf City (97.5%) because most them prefer to live in close places to their work and this fact confirm the reported of NCPP in (2012) more than (70%) of dwelling population in Al-Najaf located in urban area. Most parents worked as civil servant (46.3%) with limited income and most of their wives worked as house wives (75%) who are a free to work in his home only (table 2) and reported moderately sufficient of income (43.8%) (table 1).

On the other hand, (60.66%) of fathers and (65.08%) of mothers had information about dealing with ASD from more than one source of information; that indicator for increased awareness of parents about ASD and readiness to receive information about their child state.

The range of children's age between (3- 12) years and (51.3%) of children's age between (7- 10) years, with mean  $(6.83 \pm 2.215)$ , but range of children age was diagnosed with ASD (2-8) years and (63.75%) of them diagnosed with it in age ( $\leq 3$ ) years, with mean  $(3.29 \pm 1.245)$ . Most children had moderately severity of ASD (46.3%; mean =  $2.11 \pm .729$ ). These results revealed the nature of centers to age accepted for children and awareness of parents to their child symptoms (table 3).

The majority of children enrolled in institutes with ASD were male (77.5%). This reflects the fact that males are more vulnerable to ASD than female (table 3) (Semple & Smyth, 2013). Most parents who reported their children did not have any other health problems with ASD (51.3%). About (57.5%) of parents used both medications psycho-pharmacotherapy and other psychological therapies to treat their children and residual ratio used only psychological therapies in institutes without medications (table 3) which may be due to parents who had limited income.

Degree of inmate relationship between parents after diagnosing their child with ASD were one of important issues. About (75%) of parents reported that they had a good relationship and their relation not effected with ASD diagnosing for their child because the majority of them were married from kindred (53.8%, table 1) or parents may become closer after it. This point is confirmed by the study of MacMullin et al. (2011), but (10%) from them the relationship became bad after their

child being diagnosed and (15%) became moderately after it (table 1). The reasons may be due to the impacts of ASD on their income, work, time, changing in environment of family and their functions (Hartley et al., 2010; Derguy et al., 2015). In context the changed of health status for parents after diagnosing their child with ASD were (51.3%) of fathers and (43.8%) of mothers who reported they did not have any health problems because of ASD (table 2). It may be due to the experiences of parents in life and ability to adaptation with it or most them their ages were between 31-50 years (table 2).

Majority of parents reported no change in hours of work after diagnosing their child with ASD which may cause most them worked as a civil servant in general sector of Iraq (table 2). The system of time work in Iraq fixed and does not change to the personal or familial status or does not have other source to get financial support such as government support or from civil agencies, but (28.8%) of fathers and (7.5%) of mothers change their time of work which may be due to work in a free job, day laborer, jobless, retired or house wife (in state of mothers) (table 2). In other hand, (78.8%) of fathers and (67.5%) of mothers reported change in hours spent outside of home for not work because they need to care their child's ASD or other family members or to avoid shyness and stigma from ASD (Divan et al., 2012; Gray, 2001).

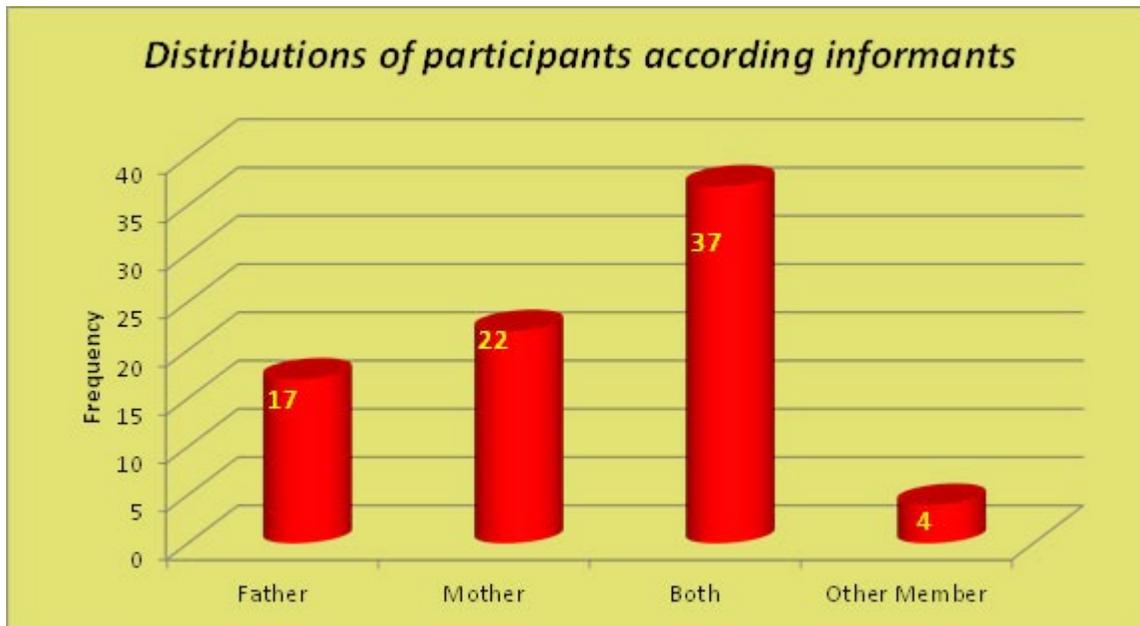
The scale of impacts on parents revealed (53.8%) of parents experienced of high degree of impacts with M.S (2.475), because their child suffered from severe to moderate ASD which were more than (78%) of (childrentable (4)).

There is no significant relationship between severity of ASD and degree of inmate relationship after diagnosing their child with ASD which may be for previous causes mentioned in above. Also, no significance relationship between the parents age and the severity of ASD (p-value for fathers and mothers  $> .05$ ), as shown in table (5) because the parents age was not one causes of incidence ASD in their child. Also, no significance among the severity of ASD and the change of hours work, hours spent outside of home and their health status ( $.319-.522 > .05$ , table (5)).

Whereas the relationship between the severity of ASD and demographic characteristics for child such as age of child or age of child when diagnosed with ASD and if the child had other health problems there was no significance ( $.121-.926 > .05$ ) which may be due to most children diagnosed in early years of life ( $\leq 3$  years old, table (3)), but the researchers found significant relationship between the types of treatment used with child and severity of ASD ( $.033 < .05$ ) which may be due to the child is needs to more treatments when severity of it increased. Also, it was found high significance between the severity of ASD and degree of impacts on parents ( $.002 < .05$ , table (5) which may be due to the impacts on parents increased when severity of ASD intense on their child.

## Conclusions and Recommendations

The researchers concluded to importance of coordination among ministries of Health, Education and Labor and Social Affairs in Iraq to construct new system services to the parents and their child who has ASD.



**Figure 1. distributions of participants according informants**

**Table 1. Socio-economic status for parents' child with ASD**

		N = 80	
		Frequency	Percent
Residence	Urban	<b>78</b>	<b>97.5</b>
	Rural	2	2.5
Income	Sufficient	28	35.0
	Moderately Sufficient	<b>35</b>	<b>43.8</b>
	Insufficient	17	21.2
Marital status	Married	<b>77</b>	<b>96.3</b>
	Widowed	1	1.2
	Separated	2	2.5
Degree of relation	Kindred	<b>43</b>	<b>53.8</b>
	Strangers	37	46.2
Number of children	≥2	<b>39</b>	<b>48.8</b>
	3 - 5	37	46.2
	More than 5	4	5.0
Degree of inmate relation after diagnosis their child with ASD	Good	<b>60</b>	<b>75.0</b>
	Moderate	12	15.0
	Bad	8	10.0
Total		80	100.0

**Table 2. Demographic characteristics for fathers and mothers who had child with ASD**

		Fathers (N=80)		Mothers (N=80)	
		Frequency	Percent	Frequency	Percent
Age	≤ 30	15	18.8	31	38.8
	31 - 50	<b>62</b>	<b>77.5</b>	<b>48</b>	<b>60.0</b>
	More than 50	3	3.8	1	1.2
Job	Civil Servant	<b>37</b>	<b>46.3</b>	19	23.8

	Retired	2	2.5	0	0
	Clerk Private Sector	6	7.5	1	1.2
	Free Job	20	25.0	0	0
	Day Laborer	6	7.5	0	0
	Jobless	3	3.8	0	0
	Student	1	1.2	0	0
	Housewife	0	0	<b>60</b>	<b>75.0</b>
	Other	5	6.2	0	0
Level education	Illiterate	4	5.0	4	5.0
	Able to Read And Write	2	2.5	3	3.8
	Primary School Graduate	13	16.3	11	13.8
	Intermediate Graduate	6	7.5	<b>21</b>	<b>26.3</b>
	Preparatory Graduate	9	11.2	12	15.0
	Institute Graduate	14	17.5	10	12.5
	College Graduate	<b>26</b>	<b>32.5</b>	15	18.6
	Post Graduate	6	7.5	4	5.0
Has information about dealing with ASD	Not has information	19	23.8	17	21.3
	Has information	<b>61</b>	<b>76.2</b>	<b>63</b>	<b>78.7</b>
Changed health status	Psychiatric Problems	17	21.2	24	30.0
	Physical Problems	16	20.0	12	15.0
	Psychiatric and Physical Problems	6	7.5	9	11.2
	Not have other health Problems	<b>41</b>	<b>51.3</b>	<b>35</b>	<b>43.8</b>
Changed hours of work	Changed	23	28.7	6	7.5
	Unchanged	<b>57</b>	<b>71.3</b>	<b>74</b>	<b>92.5</b>
Changed hours spent out of home	Changed	<b>63</b>	<b>78.8</b>	<b>54</b>	<b>67.5</b>
	Unchanged	17	21.2	26	32.5
Total		80	100.0	80	100.0

**Table 3. Demographic characteristics of children with ASD**

		N = 80	
		Frequency	Percent
Order between siblings	First	<b>36</b>	<b>45.0</b>
	Second	16	20.0
	Third	11	13.7
	Forth	11	13.7
	Fifth	3	3.8
	Sixth	2	2.5
	Eighth	1	1.3
Gender	Male	<b>62</b>	<b>77.5</b>
	Female	18	22.5
Age	≤ 6	35	43.7
	7 - 10	<b>41</b>	<b>51.3</b>
	More than 10	4	5.0

Age diagnosing with ASD	≤ 3	<b>51</b>	<b>63.75</b>
	4 - 6	27	33.75
	More than 6	2	2.5
Severity of ASD	Mild	17	21.2
	Moderate	<b>37</b>	<b>46.3</b>
	Severe	26	32.5
Types of treatments used	Without Medications	34	42.5
	Both Medications and without Medications	<b>46</b>	<b>57.5</b>
Other health problems of child	Psychiatric Problems	8	10.0
	Physical Problems	23	28.7
	Psychiatric and Physical Problems	8	10.0
	Not have other health Problems	<b>41</b>	<b>51.3</b>
Total		80	100.0

**Table 4. Degree of impacts on parents' child with ASD**

		N = 80		M.S	Assessment
		Frequency	Percent		
Degree of impacts	Low	5	6.2	2.475	Severe
	Moderate	32	40.0		
	High	43	<b>53.8</b>		
Total		80	100.0		

**Cut off point** (0.66), **M.S** (mean of scores), **Mild** (mean of score 1-1.66), **Moderate** (mean of score 1.67-2.33), **Severe** (mean of score equal or more than 2.34)

**Table 5. Relationship among severity of ASD and Demographic characteristics of parents, their children and impacts on parents**

	Demographic Data	Rating	Severity of ASD			Chi-Square			Sig.
			Mild	Moderate	Severe	$\chi^2$	df	P-value	
Parents	Income	Sufficient	7	15	6	5.66	4	.226	NS
		Moderately sufficient	7	12	16				
		Insufficient	3	10	4				
	Degree of inmate relationship after diagnosis their child with ASD	Good	15	26	19	2.9	4	.575	NS
		Moderate	2	6	4				
		Bad	0	5	3				
Fathers	Age	≤30	4	6	5	.819	4	.936	NS
		31 - 50	12	30	20				
		More than 50	1	1	1				
	Changed hours of work	Changed hours of father work after diagnosed child's ASD	7	9	7	1.68	2	.432	NS
		Unchanged hours of father work after diagnosed child's ASD	10	28	19				
	Changed hours spent out of home	Changed father's hours spent out of home after diagnosed child's ASD	15	27	21	1.72	2	.424	NS
		Unchanged father's hours spent out of home	2	10	5				

	Health status	after diagnosed child's ASD							
		Psychiatric problems	1	11	5	5.17	6	.522	NS
		Physical problems	5	5	6				
		Psychiatric and physical problems	1	3	2				
Father was not have problems	10	18	13						
Mothers	Age	≤ 30	6	15	10	3.81	4	.433	NS
		31 - 50	10	22	16				
		More than 50	1	0	0				
	Changed hours of work	Changed hours of mother work after diagnosed child's ASD	2	1	3	2.284	2	.319	NS
		Unchanged hours of mother work after diagnosed child's ASD	15	36	23				

Continues table 5.

	Demographic Data	Rating	Severity of ASD			Chi-Square			Sig.
			Mild	Moderate	Severe	$\chi^2$	df	P-value	
Mothers	Changed hours spent out of home	Changed mother's hours spent out of home after diagnosed child's ASD	13	22	19	2.08	2	.353	NS
		Unchanged mother's hours spent out of home after diagnosed child's ASD	4	15	7				
	Health status	Psychiatric problems	4	10	10	6.9	6	.331	NS
		Physical problems	5	5	2				
Psychiatric and physical problems		2	6	1					
Mother was not have problems	6	16	13						
Child	Age	≤ 6	7	17	11	.890	4	.926	NS
		7 - 10	9	19	13				
		More than 10	1	1	2				
	Child age diagnosing with ASD	≤ 3	9	29	13	7.292	4	.121	NS
		4 - 6	7	8	12				
		More than 6	1	0	1				
Other health problems of child	Psychiatric problems	0	3	5	6.664	6	.353	NS	
	Physical problems	4	12	7					
	Psychiatric and physical problems	3	4	1					
	Child was not have problems	10	18	13					
Types of treatments used with child	Without medications	9	10	15	6.84*	2	.033*	S	
	Both medications and without medications	8	27	11					
Impacts	Degree of impacts on parents	Low	2	2	1	16.82	4	.002*	HS
		Moderate	12	16	4				
		High	3	19	21				

HS: Highly significant, S: significant, NS: non-significant, P-Value: probability value, df: degree of freedom,  $\chi^2$ : chi-square observation

Majority of parents are ready to participate in special programs and accepted a new knowledge about ASD or how to care and deal with their child. Also parents need more help and necessary support from governmental and private foundations. Al-Najaf City does not have governmental centers specialized in diagnosing, caring and treating of autism. Most drugs (medications) of ASD are expensive price and not available in governmental hospitals and in psychiatric units, too. Almost all schools in Al-Najaf were not have special class for mild cases of ASD or teachers have experience to deal with ASD.

Finally, there is significant relationship among the severity of ASD on child and parents impacts, types of treatments used with a child. Also, when parents have knowledge, sufficient income and high level of education, the severity of ASD may be insignificant on them.

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# Delineation of Liver

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**Abstract-** Liver is the largest internal organ in human body. It lies under right ribs just beneath right lung, shaped like a pyramid and divided into four different lobes. It is the only internal organ which has the property of regeneration of lost tissue. It plays major role in metabolism, emulsification of lipids and stores nutrients. Accurate segmentation of liver is still a challenge due to differences in intensity, contrast and texture. In this paper we have proposed a method to extract the liver from computed tomography DICOM images using seed point in such a way that it will always be present within the liver. This method assists radiologists in accurate segmentation of liver which in turn helps the patients.

**Index Terms-** Computed Tomography, DICOM, Liver, Seed point, Segment.

## I. INTRODUCTION

This paper proposes a method for the extraction of liver. Liver is a vital organ in most of the vertebrates and animals. This gland plays a dominant role in protein synthesis, chemical production and decomposition of red blood cells. Liver's a very specialized tissue contains hepatocytes necessary for bio chemical reactions. It also plays major role in synthesis, breakdown of molecules and storage. When it comes to medical field regarding liver extraction, it's a challenging task due to high inter-organ intensity similarity and intra liver intensity variability. But accurate detection of liver helps in early treatment of liver diseases, liver transplantation and liver resection. Many algorithms have been proposed till now but most of them lack accuracy and involves loads of complexities.

Luo et al proposed the paper [2] on automatic liver parenchyma segmentation. In this paper, a multi-layer heuristic approach is introduced to segment liver region from other tissues in multi-slice CT images. Pixels are heavily misclassified and do not cater spatial information. Kyung-SikSeo proposed paper [3] on liver segmentation based on histogram processing. This paper presents a method to extract liver from computed tomography (CT) abdomen images in axial orientation. In histogram processing selecting the lower and higher threshold is difficult. The results are not accurate.

Weiwei Wu, Zhuhuang Zhou, Shuicai Wu and Yanhua Zhang proposed the paper [4] on automatic liver segmentation using graph cuts. In this paper, a novel method was proposed for automatic delineation of liver on CT volume images using supervoxels-based graph cuts. Limitation of this study is that the number of datasets for evaluation is small. O.Gambino and et al proposed the paper [6] on automatic liver segmentation based on region growing. In this paper an automatic texture based volumetric region growing method for liver segmentation is proposed. The major drawback of this method is under segmentation near liver boundaries.

Jeongjin lee, NamKug Kim, Ho lee, JoonBeomJinwon, Yong moon shin, Yeong Gil Shin and Soo-hongkim proposed a paper [8] on efficient liver segmentation using a level-set method. But in this method it is difficult to distinguish ambiguous boundary between liver and heart caused a false positive error growing method. L. Suhuai proposed a paper [7] called Review on the methods of automatic liver segmentation from abdominal images. In gray level based method, if difference between source and target is small and it is less efficient. P. Campadelli, E. Casiraghi, and A. Esposito proposed this paper [11]. Designing interactive segmentation methods for digital volume images is difficult, mainly because efficient 3D interaction is much harder to achieve than interaction with 2D images. In live wire segmentation method performance lacks when it comes to segmentation and causes errors.

So the purpose of this paper is to overcome the mentioned drawbacks and to provide an easy and efficient method to extract the liver from CT images. Out of many modalities we have Preferred CT i.e., Computed Tomography because it provides detailed 3D pictures, faster compared to other modalities, best spatial resolution and good accuracy.

## II. METHODS

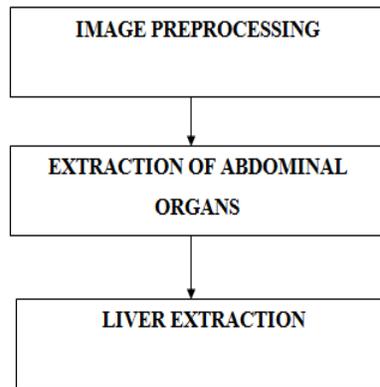


Figure 1: Flow of Execution

The Figure 1 shows the flow of execution of the proposed methodology. The first step is image preprocessing, here the input is data set provided by us. Image preprocessing is removal of distortion, noise or unwanted data. Here the input DICOM image is converted into required gray scale format. In the second step extraction of abdominal organs, the proposed method uses seed point in such a way that it will always be present within the liver region. Using this seed point, we will use pixel value of seed point and move through each pixel in original image if the pixel value is same then we will copy value to a black image. This will result in an image with liver and other small portion which has same pixel value. Then in the third step is liver extraction, we will apply region growing method by using seed point location to extract liver.

## III. RESULT

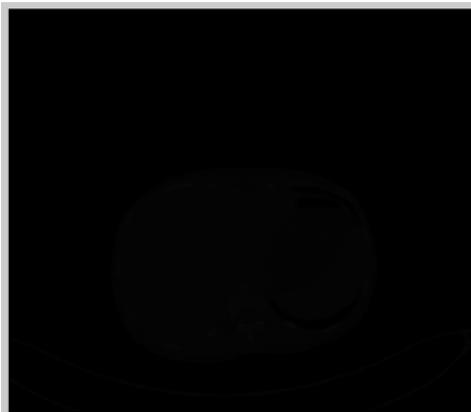


Figure 2: Input Image Matrix

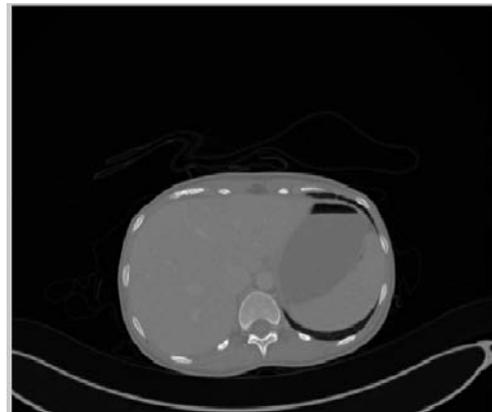


Figure 3: Preprocessed image

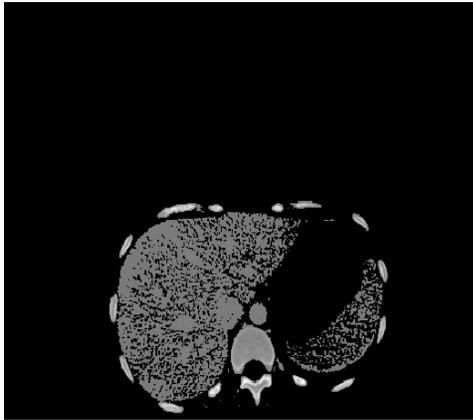


Figure 4: Extracted abdominal Organs

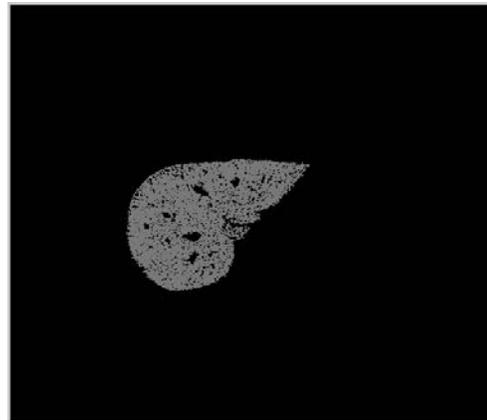


Figure 5: Extracted Liver

The input image is a 3D DICOM image as shown in Figure 2. The image is preprocessed and converted into gray format i.e., shown in Figure 3. The proposed method uses seed point in such a way that it should be present in liver region. The so obtained pixel value of seed point is compared with that of original image and if matches then copied into new matrix which results in delineation of abdominal organs as shown in Figure 4. Now the liver is delineated referring Figure 5. Using region growing method by giving seed point location.

#### IV. CONCLUSION

A method for the detection of the liver is proposed here. A complete technique has been defined for liver extraction from CT images. The proposed method is applied on the gray scale image and it relies on connected pixel components in an image. The proposed approach is not limited to the liver, can be enhanced to detect veins, lobes and lesions. We believe that our technique outperforms those presented in the literature; nevertheless this technique is simple, easy to implement and gives accurate results.

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# DESIGN OF HIGH ACCURATE DATA ACQUISITION SYSTEM FOR REAL TIME MONITORING OF POWER GRID

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**Abstract** -- Now a days Automated Systems are widely adapted for most modern industries. Data acquisition is the major component of any automation system. The robustness of the automation system mainly depends on the accuracy and speed of the data acquired from Data Acquisition System(DAS). This paper mainly focusses on the design of high accurate multi-channel Data Acquisition System for real time automation applications. Data acquisition is used to acquire data from sensors and other sources under computer control and bring the data from different channels together to store and manipulate it. The sensors may include thermocouples, voltage and current sensors to make variety of measurements from different remote locations in the industries. The proposed method can sense all the 48 channels data in two seconds. The filters used in the application makes the acquired data to be more accurate with accuracy level of 30 PPM.

**Keywords:**

## I. INTRODUCTION

It is often very useful to know the operating conditions of the electrical systems in the power grid at different situations. The

parameters like voltage, current, temperature are usually measured to study the performance characteristics of the machine or system. It is usually complicated to have constant monitoring, recording

and storing results of these parameters using the traditional measuring apparatus like meters. Hence a system is designed to have a constant monitoring and storing results of these parameters using sensor technology along with microcontroller. The sensors will sense the parameter under study. Since the output signals of sensors cannot be directly processed by the electronic system a signal conditioning circuit is used for each sensor to condition the signal. This is an analog signal and it is converted to digital signal by using analog to digital converter then they are given to the microcontroller and further to personal computer so as to achieve monitoring. This monitoring system is known Data Acquisition System (DAS).

The main aim is to design a Data Acquisition System the acquire the data with high accuracy and speed. This paper illustrates the technical approaches adopted to achieve the speed and accuracy in the system.

## II. TECHNICAL APPROACH

The proposed DAS has mainly two features:

A. Accuracy and

B. Speed

To obtain high accurate data from the sensors, 24-bit ADC is used in the application. The ADC ADS1259

from Texas instruments provides this amount of resolution. This was found sufficient as the 24-bit ADC allows for a resolution of 1 part in  $2^{24}$  which makes the system more accurate. To further improve the accuracy level in the acquired data noise from the data obtained from ADC is removed with help of digital filters.

The next main feature of the DAS is speed. To improve the speed of the DAS, single ADC is employed for all 48 channels instead of maintaining one for each. This will reduce the amount of hardware and its settling time. So the speed of the system is improved. To further improve the speed of the system, firmware filters are employed instead of hardware filters. This will further reduce the hardware which will further improve the speed.

### III. DATA ACQUISITION SYSTEM

The functional block diagram of proposed DAS is shown in Fig1. The major peripherals of the proposed DAS that need to be controlled through firmware are as follows.

- Sensor Input Module (SIM)
- Multiplexer
- ADC
- Microcontroller
- Single Board Computer

#### Sensor Input Module

Sensor Input Module(SIM) is a hardware component that acts as a casing for different output sensors. The proposed DAS has four SIMs. Each SIM has the capability of holding twelve sensors. Therefore, all four SIMs hold a total number of 48 sensors. The SIM provides mechanical support to the sensors connected to it and also provides support for switching the channels.

#### Multiplexer

Multiplexer(MUX) acts as a switch to select one channel at time from available 48 channels. MUX switching was under the control of microcontroller. The micro controller was programmed to keep

switching the different sensor channels. Truth table was developed for switching between different sensor channels.

#### ADC

An A/D converter does exactly what its name implies. It is connected to an analog input signal, it measures the analog input and then provides the measurement in digital form suitable for use by a computer. The A/D converter is the heart of any analog input DAQ system as it is the device that actually performs the measurement of the signal.

#### Microcontroller

Microcontroller is the brain of any computing system. It controls the functions of the all the peripherals connected to it. This application uses STM32F407IGT7 micro controller from ST microelectronics. Microcontroller collects the data from sensors through ADC and sends the data to Single Board Computer(SBC) after performing digital filtering actions on the data to remove the noise.

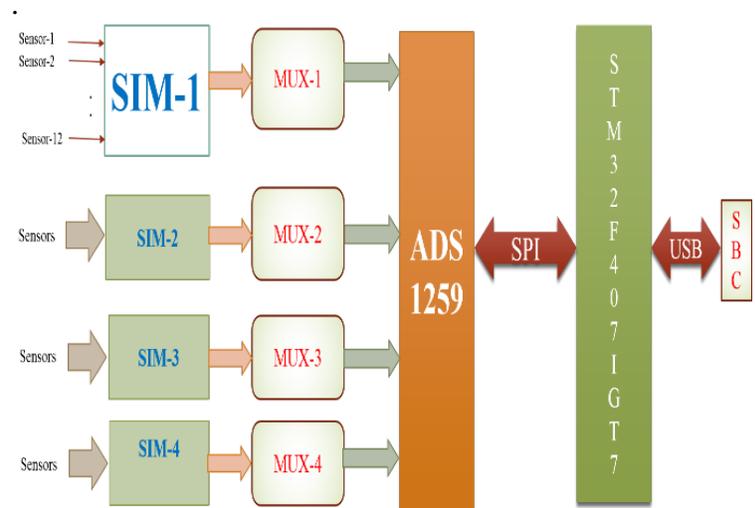


Fig.1 Functional block diagram of Data Acquisition

#### Single Board Computer

A single-board computer (SBC) is a small computer built on single chip that has the same features as functional computer such as microprocessor, memory, input/output etc., In this application, SBC is used to store the live data

obtained from the sensors through microcontroller via USB communication protocol.

#### IV. DATA FLOW IN DAS

The data movement from the sensor to microcontroller output is described in flow chart. The flow starts from setting processor peripherals and initialize the channel data. Check the frequency of line whether it is 50 Hz or not if not change the settings. After finalizing the one channel switch the next channel followed by set the input and output gain of the Programmable Gain Amplifier (PGA). Give start command to ADC to convert the amplified analog signal to digital value to process and control the data in microcontroller.

The digital data is attained if the DRDY pin of the ADC is low otherwise the process waits for checking any errors and starts from initial step. using buffer, the digital data acquired from the ADC is stored after filling the buffer up to 10 samples reset the flag for the next count. After getting digital data from ADC fed it into microcontroller for the processing the data, like interpolate the data and decimation and increment the processor counter n times and rest the counter for the next count and clear the buffer and reset the full flag.

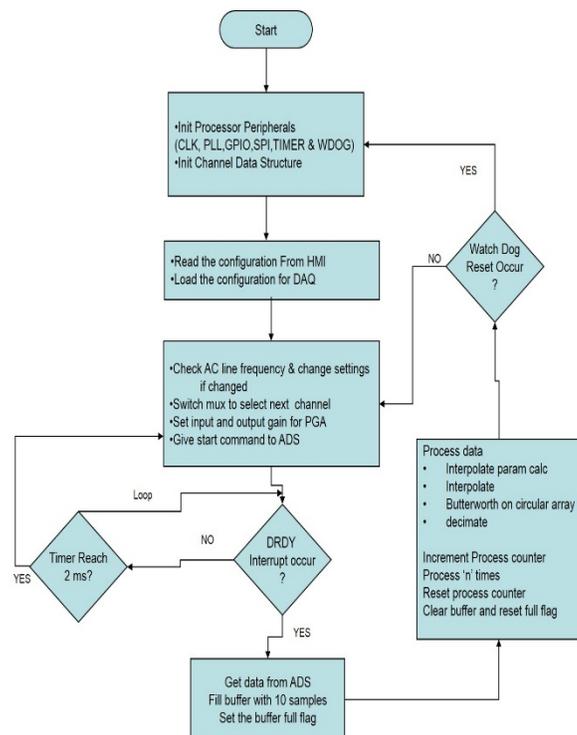


Fig.3 Data flow of DAS

This data flow is controlled and closely observes the watchdog from the various commands if there is no interlude it just start the loop from multiplexer otherwise its start again from initial condition.

#### V. OPERATION OF PROPOSED DAS

The micro controller was programmed to keep switching the different channels through multiplexing action. Truth table was developed for multiplexing action to switch one channel at a time from available 48 channels.

The flow chart for micro controller programming is shown in Fig3. The overall data acquisition process is as follows.

##### Initialization

When the system switched on the micro controller initializes various peripherals connected to it such as clocks, GPIOs, timers, watch dogs, serial communication engines etc.,

The channel selection data structure and interrupt vector address are loaded into the program memory. The microcontroller checks for AC line frequencies to which it is configured at present state and corresponding settings were initialized.

ADC is initialized through SPI communication protocol and correspond registers are initialized.

##### Channel selection

The sensor/channel was selected for obtaining data by loading corresponding value in the truth table onto the output ports. After the selection of channel, the sensor is ready to give input to the ADC.

##### ADC conversion process

When the sensor is ready to give output, the start command is given to ADS1259 from microcontroller. The ADC start conversion process. When the conversion process was over the ADC asserts data ready line (DRDY) which provides interrupt to the microcontroller telling data is ready to read. At each

conversion process ADC provides ten samples of data at its output.

If the DRDY line is not asserted during channel scanning time which usually 20ms, the controller waits up to grace period which is usually 5ms for data. If still data is not available, the controller provides time out for that channel and switch to next channel.

**Data Processing**

The data obtained from ADC is not accurate and contains various frequency components in it. To obtain high accuracy in the accurate data, the noise frequency components as well power line frequency components has to be removed. For this, digital filters are designed and implemented in data acquisition firmware.

Digital low pass filter is implemented with cut-off frequency 5 Hz. It shows good attenuation response to the high frequency components. But this filter has poor attenuation response at 50Hz frequency. This project was majorly working at power line frequency of 50Hz, which is the major noise component to filter out from ADC output data.

The combined response of the digital low pass filter and notch filter is shown in Fig. 4. From the Fig. 4, it should be noted that the attenuation of power line frequency component is nearly -60dB, which is at acceptance level.

The transfer functions of the low pass filter and notch filter is shown in equation (1) & (2) respectively.

$$A = \frac{1}{0.001013s^2 + 0.04502s + 1} \dots (1)$$

$$A_{Notch} = \frac{s^2 - 1.6186 + 1}{s^2 - 1.616s + 0.998} \dots (2)$$

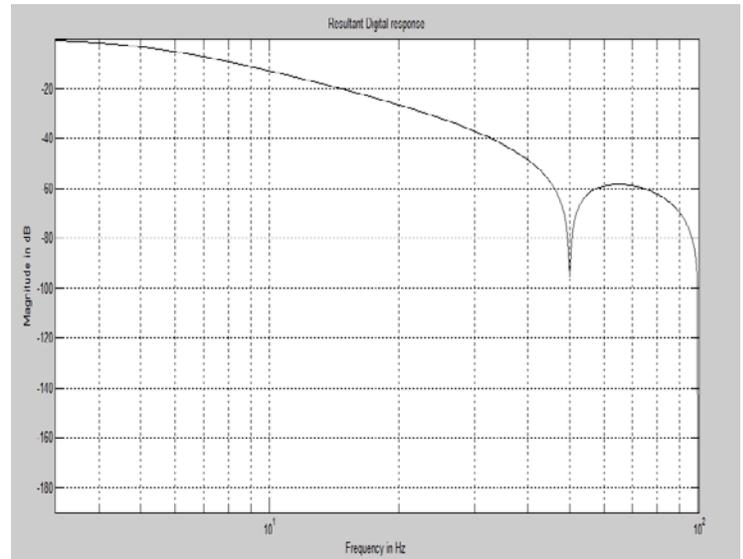


Fig.4 Digital low pass notch filter response

These two digital filters are implemented in firmware to increase the data rate by avoiding analog filters.

**Data conversion**

The ADC counts corresponding to the input to the sensor are passes through various filtering stages. The output from the digital filters is the filtered ADC counts corresponding to the actual input parameters. The actual parameters can be calculated from the ADC reference values. The service routine can be implemented in the firm ware to convert the ADC counts in the actual parameters.

**Data storage**

Once the data from ADC passed through various filtering stages, the noise in the data is removed, the filtered data which is in the form of ADC counts corresponding to the input parameters is converted into actual values. The final actual data is sent to the Single Board Computer to store and also the stored data is sent to the control center from remote location.

**VI. APPLICATIONS**

The proposed DAS has find its applications in the following areas.

1. In power system the DAS find its applications in the RTUs to send the real time data from remote locations to the control center

2. Due to real time monitoring, the proposed DAS can be used in the industrial automation to control the parameters automatically.
3. In biomedical applications, the DAS can be used to measure the ECG and EEG signals very accurately.
4. The proposed DAS has find its application in the power quality measurements.

In most cases, the data acquisition system provides the much needed real time data for the analysis of a particular fault. It can also provide the required data to optimize a control system in a given process industry.

### VII. CASE STUDY

The prototype was developed based on the above principle to measure the data of voltage, current and temperature of the transformer.

The measured data from the transformer was sent to the remote location usually a control room to monitor and control. The transmitter and receiver sections of the prototype are shown in the Fig. 5 and Fig. 6 respectively.

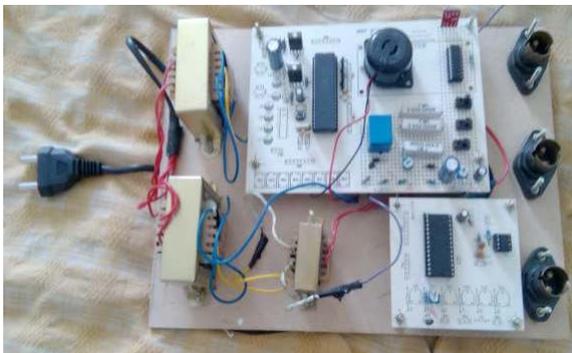


Fig 5: Hardware setup for transmitter section

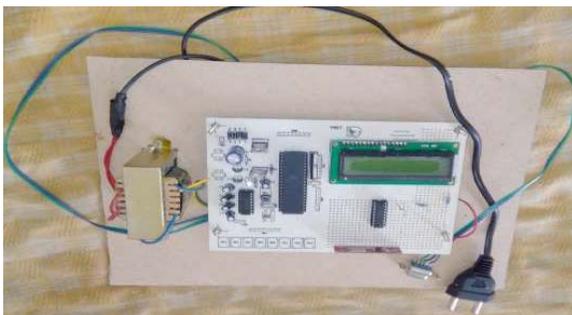


Fig 6: Hardware setup for receiver section

The measured data is send to the receiver section through RF wireless transmission. When the measured parameters exceed the pre-stored limits in the micro controller, an alarm signal is generated to make the operational alert. The limiting values are shown on the Table 1.

**Table 1:** Limiting values of the parameters of the transformer

Parameter	Limiting values
Voltage(v)	$220\text{ V} \leq v \leq 230\text{ V}$
Current(I)	$I < 100\text{ mA}$
Temperature(T)	$T < 50\text{ }^\circ\text{C}$

### VIII. CONCLUSION

The multi-channel Data Acquisition System based on a STM32F407IGT7 microcontroller from ST Microelectronics is designed, developed and tested. The advantage of using the proposed DAS is that the Analogue to Digital Converter (ADC) with 24-bit resolution was used that makes the DAS to obtain high accurate data from measurement world. This allows for a measuring accuracy of one part in  $2^{24}$ . The digital filters used in this DAS eliminates high frequency and power line frequency components in the measured data and most accurate data is sent to the Single Board Computer. The accuracy level of the measured data when tested was found to be 30 PPM.

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# Total Coloring of Closed Helm, Flower and Bistar Graph Family

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**Abstract-** A coloring of vertices and edges of a graph  $G$  is said to be total coloring if no two adjacent or incident elements of have the same color. The minimum number of colors required for a total coloring is said to be the total chromatic number of  $G$  and is denoted by  $\chi_T(G)$ . In this paper, we have discussed the total chromatic number of closed Helm, Flower and Bistar Graph Families.

**Key words-** Total coloring, total chromatic number, closed Helm, Flower Graph, Bistar Graph.

## 1.INTRODUCTION

A total coloring of a graph  $G$  in an assignment of colors to the vertices and edges of  $G$  such that no two adjacent or incident elements have the same color. The minimum number of colors required for a total coloring of a graph  $G$  is known as total chromatic number and is denoted by  $\chi_T(G)$ . The total coloring was introduced independently by Behzad[1] and vizing[10] as Total coloring conjecture (TCC), which states that  $\chi_T(G) \leq \Delta(G) + 2$  for any graph  $G$  with maximum degree  $\Delta(G)$ . Hilton et al[5] has verified this conjecture for graphs with  $\Delta(G) \geq \frac{3}{4}|V(w)|$ . TCC has also been verified by Kostochka[7] for graphs with  $\Delta(G) + 5$ . Molloy and Reed [9] has shown that there is a constant  $C$  such that  $\chi_T(G) \leq \Delta(G) + C$ . The research work of finding total chromatic number for paths cycles, complete and complete bipartite graphs[2], complete multipartite graphs of odd order[4,6], planar graphs  $G$  with  $\Delta(G) \geq 11$ [3], and outer planar graphs [12] has also been done in the past. Sudha et al [8] has found the lower and upper bound for the total chromatic number of a new graph called  $S(n,m)$ -graph for even  $n \geq 2m+2$  and for odd  $m > 1$ . They has also found the total chromatic number of  $S(n,2)$  for all  $n \geq 6$  and  $S(n,3)$  for odd  $n \geq 7$ . Vaidya et al [11] have investigated the total chromatic number of some cycle related graphs.

In this paper, we investigate the total chromatic number of closed Helm, flower graph and bistar graphs family.

## II. Total coloring of closed Helm Graph family.

In this section, we have obtained the total chromatic number of Closed Helm Graph Family

### 2.1 Definition (Closed Helm)

A closed helm  $CH_n$  is the graph obtained by taking a helm  $H_n$  and adding edges between the pendant vertices.

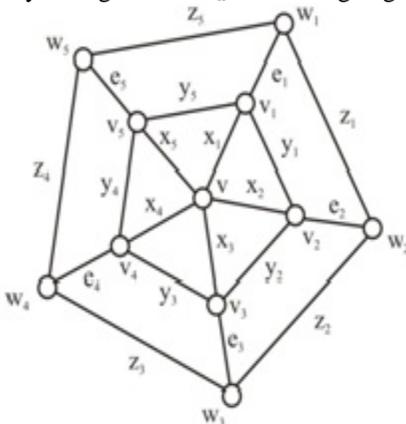


Fig.1. Closed Helm  $CH_5$

### 2.2 Coloring Algorithm:

Input ; Closed Helm  $CH_n$

$V \leftarrow \{v, v_1, v_2, \dots, v_n, w_1, w_2, \dots, w_n\}$

$E \leftarrow \{x_k \leftarrow v v_k (k = 1 \text{ to } n); y_k \leftarrow v_k v_{k+1} (k = 1 \text{ to } n-1), y_n \leftarrow v_n v_1; e_k \leftarrow v_k w_k (k = 1 \text{ to } n)\}$

$z_k \leftarrow w_k w_{k+1} (k = 1 \text{ to } n-1); z_n \leftarrow w_n w_1\}$

$v \leftarrow 1;$

```

    For k = 1 to n
        {
            xk ← k+1 ;
        }
    end for
    For k = 1 to n
        {
            r ← k + 2 ;
            If r ≤ n+1,
                vk ← r ;
            else
                vk ← r - n ;
            }
    end for
    For k= 1 to n
        {
            s ← k + 4 ;
            if s ≤ n+1,
                zk, yk ← s,
            else
                zk, yk ← s - n
            }
    end for
    For k= 1 to n
        {
            ek ← 1 ;
        }
    end for
    end procedure
    
```

Output : vertex, edge colored closed Helm.

2.3 Theorem:

The Total chromatic number of closed Helm is n+1.

(i.e)  $\chi_T(CH_n) = n+1, n \geq 4$ .

Proof :

Since the maximum degree is n,  $\chi_T(CH_n) \geq n+1$ . The color class of 1 is  $\{v, e_k ; k = 1 \text{ to } n\}$ . The color class of k ( $2 \leq k \leq n + 1$ ) is  $\{x_{k-1}, v_t, y_s, z_s, w_{k-1}; t = k - 2 \text{ if } k > 2 \text{ and } t = n \text{ if } k = 2, s = k - 4 \text{ if } k > 4 \text{ and } s = n + k - 4, 2 \leq k \leq 4\}$ . Clearly, the elements in each color classes are neither adjacent nor incident. Therefore, the coloring given in the algorithm 2.2 is a total coloring of closed Helm.

Hence,  $\chi_T(CH_n) = n + 1, n \geq 4$ .

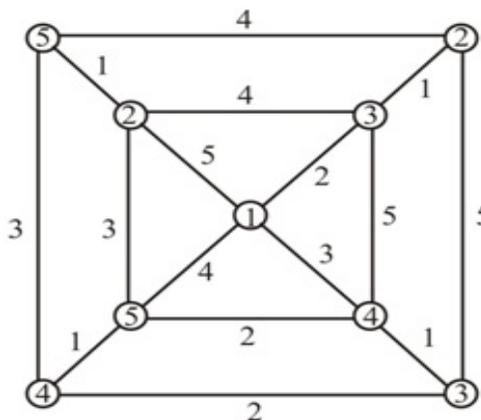


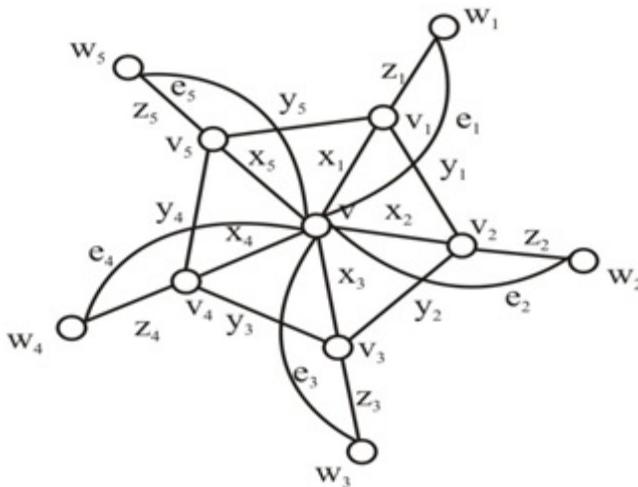
Fig.2.  $\chi_T(CH_n)=5$

### III.Total coloring of Flower Graph family

In this section, we have obtained the total chromatic number of Flower Graph Family.

#### 3.1 Definition (Flower Graph)

A flower graph  $F_n$  is the graph obtained from a helm by joining each pendant vertex to the central vertex of the helm.



**Fig.3.Flower graph  $F_5$**

#### 3.2 Coloring Algorithm:

Input :  $F_n$  ( $n \geq 4$ )

$V \leftarrow \{v, v_1, v_2, \dots, v_n, w_1, w_2, \dots, w_n\}$

$E \leftarrow \{x_k \leftarrow v v_k (k = 1 \text{ to } n); y_k \leftarrow v_k v_{k+1} (k = 1 \text{ to } n - 1), y_n \leftarrow v_n v_1; z_k \leftarrow v_k w_k (k = 1 \text{ to } n); e_k \leftarrow v w_k (k = 1 \text{ to } n)\}$

For  $k = 1$  to  $n$

```
{
    v, z_k ← 1 ;
}
```

end for

For  $k = 1$  to  $n$

```
{
    x_k ← k+1 ;
}
```

end for

For  $k = 1$  to  $n$

```
{
    e_k ← n + 1 + k ;
}
```

end for

For  $k = 1$  to  $n$

```
{
    r ← k+4 ;
    if r ≤ n + 1,
        y_k ← r ;
    else
        y_k ← r - n ;
}
```

end for

For  $k = 1$  to  $n$

```
{
    s ← k+2 ;
    if s ≤ n+1,
        v_k ← s ;
    else
        v_k ← s - n ;
}
```

end for

```

    For k = 1 to n
        {
            wk ← k + 1 ;
        }
    end for
    end procedure
    Output : vertex, edge colored Fn.
    
```

3.3 Theorem

The total chromatic number of Flower Graph is  $2n + 1$ .

(i.e)  $\chi_T(F_n) = 2n + 1, n \geq 4$

Proof :

Since  $\Delta(F_n) = 2n$   $\chi_T(F_n) \geq 2n+1$ . The color class of 1 is  $\{v, z_k ; k = 1 \text{ to } n\}$ . The color class of  $k$  ( $2 \leq k \leq n + 1$ ) is  $\{x_{k-1}, v_t, y_s, w_{k-1} ; t = k-2 \text{ if } k > 2, t = n \text{ if } k = 2, s = k-4 \text{ if } k > 4, s = n+k-4, 2 \leq k \leq 4\}$ . The color class of  $k$  ( $k = n + 2 \text{ to } 2n+1$ ) is  $\{e_{k-n-1}\}$ . Each color class is independent and hence the coloring given in the algorithm 3.2 is a total coloring of  $F_n$ .

$\therefore \chi_T(F_n) = 2n+1, n \geq 4$ .

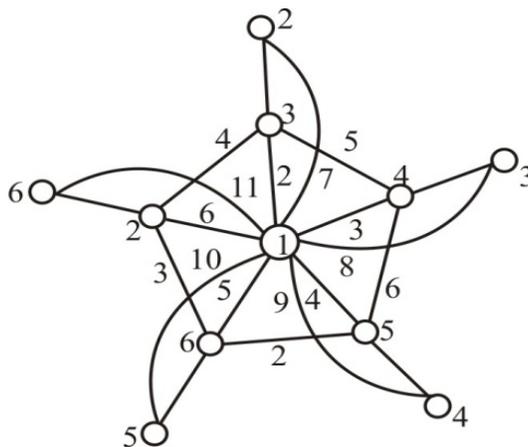


Fig.4.  $\chi_T(F_n)=11$

IV. Total coloring of Bistar graph family.

This section deals with the total chromatic number of a special type of tree, called as Bistar Graph.

4.1 Definition (Bistar)

Bistar graph  $B_{m,n}$  is the graph obtained from  $K_2$  by joining  $m$  pendant edges to one end and  $n$  pendent edges to the other end of  $K_2$ .

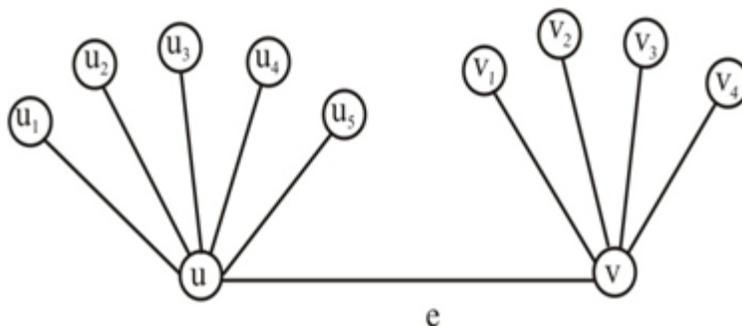


Fig.5. Bistar graph  $B_{m,n}$

4.2 Coloring Algorithm

Input :  $B_{m,n}$  ( $m, n \geq 2$ )

$V \leftarrow \{u, v, u_1, \dots, u_m, v_1, v_2, \dots, v_n\}$

$E \leftarrow \{e \leftarrow uv, x_k \leftarrow uu_k (k = 1 \text{ to } m) ; y_k \leftarrow vv_k (k = 1 \text{ to } n)\}$

$v \leftarrow 1 ; e \leftarrow 2 ; u \leftarrow 3 ;$

For  $k = 1$  to  $m$

{

```

        xk ← k + 3 ;
    }
end for
For k = 1 to n
    {
        yk ← k + 3 ;
    }
end for
For k = 1 to n
    {
        uk ← 3 ; vk ← 1 ;
    }
end for
end procedure.
Output : Vertex and edge colored Bm, n.
    
```

4.3 Theorem:

The total chromatic number of Bistar graph family is  $\max(m, n) + 3$ .

(i-e  $\chi_T(B_{m,n}) = \max(m, n) + 3, m, n \geq 2$ .)

Proof :

Consider the Bistar graph  $B_{m,n}$  whose vertices and edges are colored as in algorithm 4.2 Since  $\Delta(B_{m,n})$  is either  $m(m > n)$  or  $n(n > m)$   $\chi_T(B_{m,n}) \geq \max(m,n)+1$ . The color class of 1 is  $\{u, v_k ; k = 1 \text{ to } n\}$ . The color class of 2 is  $\{e\}$ . The color class of 3 is  $\{v u_k ; k = 1 \text{ to } n\}$ . The color class of  $k$  is  $(4 \leq k \leq \max(m,n)+3)$  is  $\{x_{k-3}, y_{k-3}\}$ . Clearly, the elements of each color classes are neither adjacent nor incident. Therefore, the coloring given in the algorithm 4.2 is a total coloring of  $B_{m,n}$ .

Hence,  $\chi_T(B_{m,n}) = \max(m,n) + 3, m, n \geq 2$ .

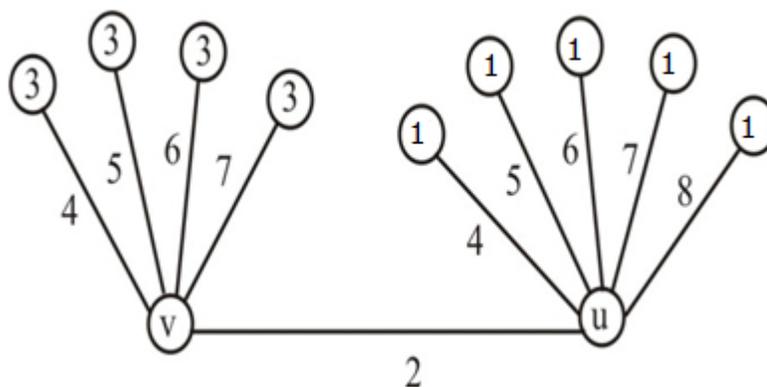


Fig.6.  $\chi_T(B_{4,5})=8$

V. Conclusion

In this paper, we have obtained the following results.

- (i).  $\chi_T(CH_n) = n + 1, n \geq 4$ .
- (ii).  $\chi_T(F_n) = 2n + 1, n \geq 4$ .
- (iii).  $\chi_T(B_{m,n}) = \max(m, n) + 3, m, n \geq 2$

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# Identify the Opportunities and Constraints in Career Progression for Women in the Hotel Industry with Special Reference to Southern Province

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**Abstract-** Tourism industry is often considered as a labor intensive sector and mostly the women can be a frill for the industry since they actively participate with the operation. A study by Zhong, (2006) indicates that, women are struggling to reach the top in the hospitality industry, and that women are subordinate to men. Therefore, the objectives of this study are to identify the opportunities for women for the career advancement in hotel industry, to identify the constraints that are preventing them from fulfilling their career ambitions and to determine the special positions of women holding in tourism and hospitality workforce as a diverse culture in an organization in four departments separately. Primary data collected by the author from 14 human resource managers and 67 female employees interviewed using purposive sampling method and stratified sampling method in southern province are the main source of data. Both quantitative and qualitative data analysis methods were deployed. The findings reflect that, Socio-cultural and organizational factors, work and family conflicts and gender discrimination as the factors that affect women's career progression in the hospitality industry and organizational background for women to pursue top ranks in hotel industry in southern province. In conclusion, women participation and women in top positions in hotel industry in southern province in Sri Lanka is considerably low due to lack of formal and informal networking and lack of visible women in senior positions whereas work and family life balancing, gender bias and dominant masculine culture were not affected for career advancement with reference to the findings. Management decisions and policies are seeking to provide separate strategies for women employees to increase the productivity and quality of the service.

**Index Terms-** HRM, Gender discrimination, Strategies, Career progression and constraints, Southern province

## INTRODUCTION

Women participation into the professional world changed the dynamics of the workplace and being a member of workforce has, without a doubt, changed over the past few decades. Tourism industry is often considered as a labor intensive sector and mostly the women can be a frill for the industry since they actively participate with the operation. Tourism presents a wide range of income generation opportunities for women in both formal and informal employment and tourism provides better opportunities for women's participation in the workforce, women's entrepreneurship, and women's leadership than other sectors of the economy (Global Report on Women in Tourism 2010). Knowles (1998) has stated that tourism and hotel industry consists of a complex blend of tangible and intangible elements of products food, drinks, accommodation and the service, atmosphere and image that surrounds them (this sentence is bit unclear to me). Although women have become a considerable percentage and good number of women has been promoted to greater positions in organizations Li, Tse, & Xie, (2007) noted that women represented few top management positions compared to the overall employment.

For many years, women in hospitality industry has been a less number which is due to "Glass Ceiling Effect" which prevents women in the field from ascending to the upper ranks of supervisory and managerial positions, become a minor effect while another factors are taking place as barriers. Women employees as managers often concentrated in supervisory and line management positions whilst male dominates the upper management position.

Women are often concentrated as low paid, low states in every field and they have lack of educational opportunities, slow salary increases and low recognitions as a sub part of career advancement opportunities. Career Progression is not the same as Career Development which is the term most people are accustomed to use. People are often attracted to a particular job, industry or a position for career development through training, educating and knowing about the job to fulfill and match life desires and goals. Moreover women face several barriers which can be recognized as career advancement constraints. Constraints can be defined as characteristics or circumstances that limit women's ability to progress in their career within the hospitality industry (Zhong, 2006).

According to the World Tourism Organization (UNWTO's annual report), there are known to be challenges facing women in tourism. Women are often concentrated in low status, low paid and precarious jobs in the tourism industry where gender stereotyping and discrimination exist. Women mainly tend to perform jobs such as cooking, cleaning and hospitality but it provides better opportunities

for women’s participation in the workforce, women’s entrepreneurship, and women’s leadership than other sectors of the economy as identified by few researches. A study by Zhong, (2006) indicates that women are struggling to reach the top in the hospitality industry, and that women are subordinate to men.

Since Sri Lanka is becoming most currency generating industry recently has changed the structure of labor pool and status quo. Researchers have found that Sri Lanka has achieved most of the human development goals but the active female participation in the economy is relatively low. Females account for as much as 70% of the population that is classified as ‘economically inactive’. Even of those who are ‘economically active,’ the number of women in the workforce (33%) remains far below that of men (67%).women are earning simultaneously to their male counterparts and equal safe work place environment are contradictory arguments when the point of view of industry professionals indicate positive foundation for women and negative environment issues in tourism industry. Percentage of women working in tourism (including catering, restaurant and hotel industries) varied greatly from region to region, ranging from 2 per cent to over 80 per cent proving that women participation in tourism industry is to be still covered for future research to investigate carrier advancement and potential risks involving in the industry.

### METHODOLOGY

Based on the research objectives, this research is documented through a survey conducted with 14 human resource managers and 67 female employees in southern province. The study employed purposive sampling method to select number of HR managers and stratified sampling method to select number of women employees. The criterion for the stratification was to cover all levels in hotel. The sample consists of representation of each level employees and employees in main four departments (Housekeeping, Front office, Kitchen and Food and Beverage) and other sub departments (Accounts, Spa, Gym, Gardening, Engineering and Maintenance).

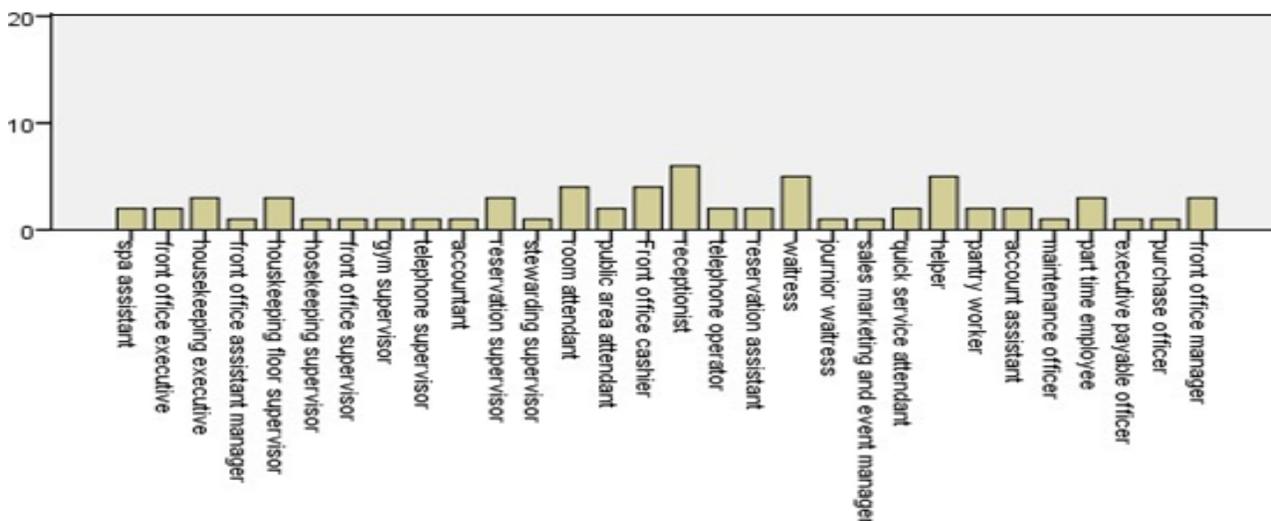
In order to achieve objectives of the research, the analysis used both quantitative and qualitative techniques. Quantitative data were obtained by means of semi structured questionnaire. The quantitative data were analyzed by Statistical Package for the Social Sciences (SPSS) and Minitab. Descriptive analysis, including means was calculated along with frequencies, graphs, charts and tables. Content analysis was used to analyze open ended questions and personal interview data. Qualitative data were collected by means of a structured interview.

### RESULTS AND DISCUSSIONS

#### 4.1 Descriptive analysis

Study has revealed that the women participation for the senior management positions are considerably low than the male counterparts. The following graph describes the female participation from the top level to bottom level.

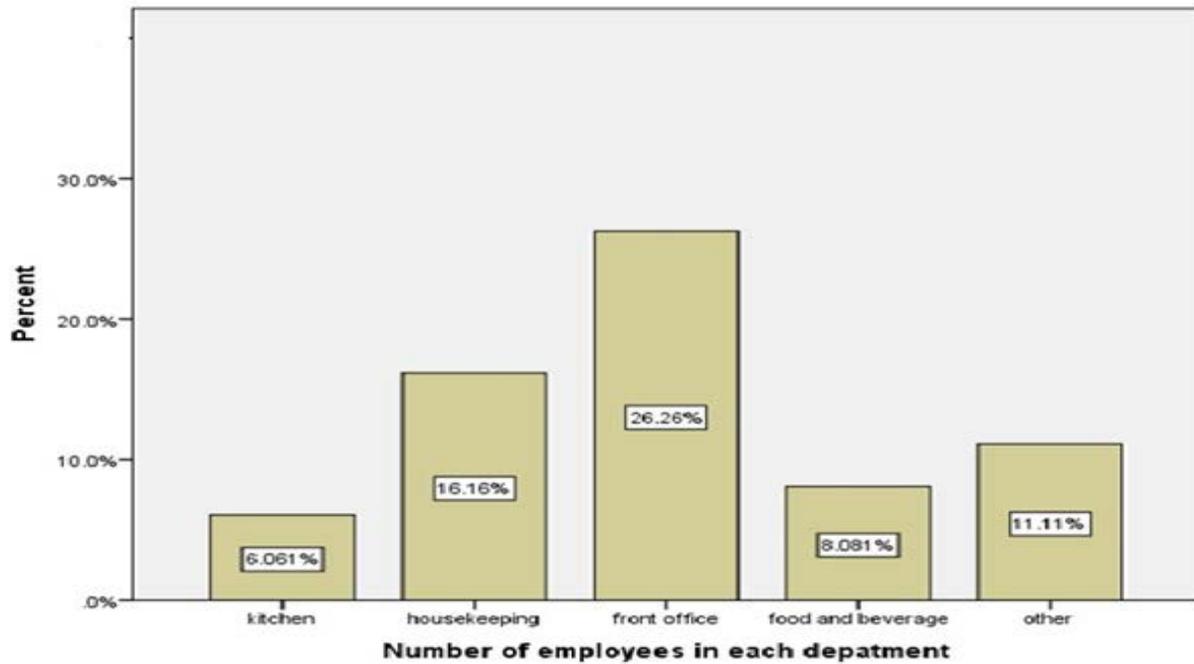
Figure 4.1 Women employee distribution N= 67



Source: SPSS outputs of the research

The figure 4.1 shows the distribution and composition of women employees in star classified hotels in southern province. The results have proven that the literature related to career advancement is similar to the hotel industry in any country showing that the women in senior position is obviously low compared to men in industry. The opinion of HR managers is these job structure has created within the industry since most job categories are not suitable for women employees.

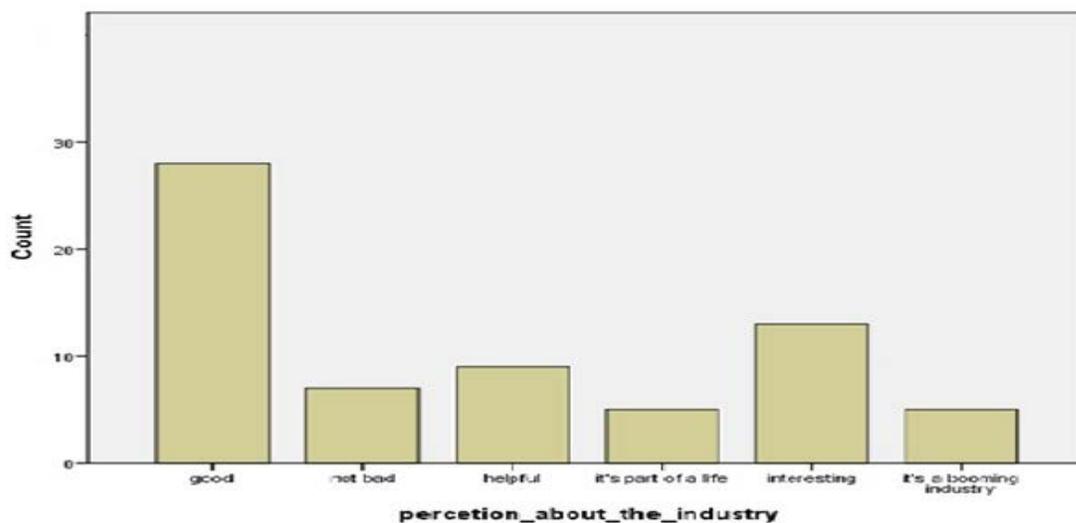
Figure 4.2 The departmental distribution of women employees



Source: SPSS outputs of the research

Study results revealed that there are restricted jobs for women in departments which are noted as kitchen and the food and beverage department confirming that women employees are underrepresented with the reason of night shift jobs are usually pertain with kitchen department where services are operated 24 hours probably and food operations in hotels are known to be comprise of male employees.

Figure 4.3 Perception about the hotel industry



Source: SPSS outputs of the research

The figure 4.3 indicates that every employee in hotel industry has given positive answers about the industry. Everyone has accepted the industry as a good industry whilst some others rated it as a part of a life and the industry helps them increasing their life standards.

#### 4.2 Opportunity identification of women employees for career advancement

Opportunity identification of women employees for career advancement were measured under the four factors namely, Special job position for women, Career advancement for other departments, Effect from gender bias to the formal network among employees and Assistance of hotel management for career advancement.

Majority of them stated that the hotel requires more waitresses, receptionists and especially for accounts and marketing departments. Studies by Mainiero (1994) and Chew & Zhu (2002) and Kandola, (2004) have identified a number of key success factors for women who have broken the glass ceiling. The factors predominantly relate to individual performance, soft skills, attitude towards work and skill development. Few numbers have found to reject the conception of special job positions for women, according to the responses some of them have stated that women are able to do whatever job role that they are assigned to perform. The results counted from HR managers stated that they usually do not recruit women for special positions but the number of job application receiving from women applicants are normally applying for jobs which are said to be suitable and allocated for women employees by the applicants. Out of 67 women employees, only two have commented that they wish to have career advancement for another department from the current position under a reason from which they could gain more knowledge and experience within the hotel while relocating and moving around the hotel in different departments. The data analyzed indicates that gender bias is not an effect for the formal network that encourages women to have career advancement through better communication and the job accountability. The survey was successfully gathered most important facts that would build a clear conclusion for real career advancement opportunities. Though women employees are ready to take the challenge of being an active employee in the hotel industry in spite of avoiding situations for degradation of job, hotels can be out of favors of career advancement for women employees.

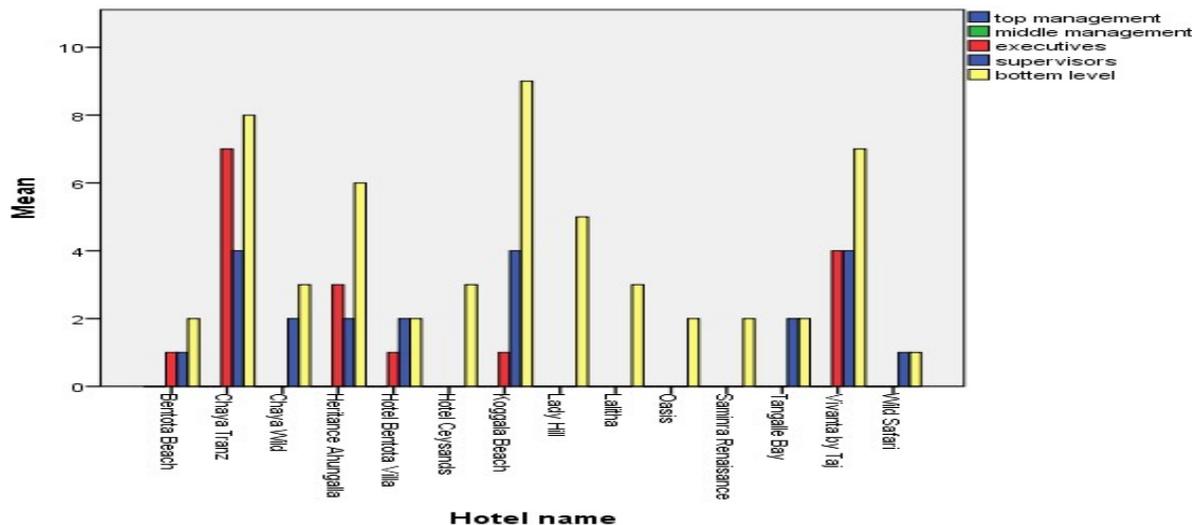
#### 4.3 Factors that should improve for career development opportunity

Career development is not only promotion or salary increment but the satisfaction of current status that they are having. Organizational expectations relate to the skills, competencies and attitudes required for job performance. In the hotel context organizational expectations predominantly relate to individual performance, skill development and acquisition of political nous and interpersonal skills such as positive mindset, understanding business culture, positive thinking and proactive nature for career development. The respondents identified the different organizational and personal development factors as important in affecting women progression in the hospitality industry such as, Personality, attitude towards work, support and guidance from a mentor, educational qualifications and luck. Every response of women employees stated that they are capable of working in any environment and are able to face for changes in the work place.

#### 4.4 Factors that affect Women's career progression in the hospitality industry

This study identified and classified the factors that affect women's career progression in the hospitality industry into five categories, namely; the difficulty of combining work at senior level with caring responsibilities, a dominant masculine organizational culture, Preconceptions and gender bias, a lack of networking and exclusion from informal networks of communication and lack of visible women in senior positions.

Figure 4.4 Employee distributions among different levels in hotels



Source: SPSS outputs of the research

Figure 4.8 above shows that any of the hotels do not consists of top and middle management level female employees. The results describes women are still underrepresented in hotel sector compared to other industries. Many of the female employees have mentioned that they do not have personality and confidence to mix up with foreign guests and visitors as they see it in other senior male employees they work under. The hotel managers addressed and discussed the issue of inadequate female role models in the hospitality industry and lack of visibility. The inadequacy of female role models was thought to have been occasioned by the limited number of female managers in the industry. Previous studies by Ng, & Pine, (2003) found that the limited number of female role models in the hospitality industry may be a contributing factor to the slow movement of women to top positions.

### CONCLUSIONS AND IMPLICATIONS

The findings reflect that, job related characteristics such as long hours, flexible hours, strategies for women gender discrimination. Moreover Socio-cultural and organizational factors, work and family conflicts and gender discrimination as the factors that affect women’s career progression in the hospitality industry and organizational background for women to pursue top ranks in hotel industry in southern province. In conclusion, women participation and women in top positions in hotel industry in southern province in Sri Lanka is considerably low due to lack of formal and informal networking and lack of visible women in senior positions whereas work and family life balancing, gender bias and dominant masculine culture were not affected for career advancement with reference to the findings. Moreover capabilities of women employees are in expected level for the career progression and many job categories should be opened for women despite of the gender. Management decisions and policies are seeking to provide separate strategies for women employees to increase the productivity and quality of the service.

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# Driving Factors and Obstacles in the Implementation of National Health Insurance among In-patient Utilization in Indonesia: A Critical Review towards Top-down Policy

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## Abstract

The implementation of National Health Insurance (*Jaminan Kesehatan Nasional*, JKN) policy was carried out to provide in-patient care coverage for all people in Indonesia. This study examined the driving factors and obstacles in in-patient care in South Sulawesi Province with highest utilization rate and Maluku Province with the lowest rate from the perspective of top-down policy according to the theory of Edwards III. Data collection conducted by doing in-depth interviews with national and local government in Jakarta, South Sulawesi and Maluku provinces in 2016 includes Health Ministry, Health Providers, and Social Security Agency and we analyze the influencing factors with literature review on previous studies and statistical data. The driving factors found in JKN implementation are ease of access to health services, rising number of participants, referral destination, growth number of medical facilities, and commitment support from the local government. In contrast, the main obstacles found were geographical challenge, disparity of health workers, and lack of adequate health service facilities. This finding shows that the cooperation of community as a stakeholder (*gotong royong*) took a major role in determining the goals of JKN implementation. The value of *gotong royong* found in the JKN policy is a bottom-up perspective which is a novelty in this policy but not covered in Edwards III's theory.

**Key Words:** Top-down Policy Edwards III, JKN Indonesia, In-patient Utilization

## 1. Introduction

Indonesia started to implement healthcare integrally through BPJS Health on January 1, 2014.

Gradually, this healthcare participation, which is called *Jaminan Kesehatan Nasional* (JKN), is expected to provide coverage for all Indonesian people by 2019 (Universal Health Coverage/ UHC) (Harimurti, Pambudi, Pigazzini, & Tandon, 2013). The implementation of JKN is based on the mandate of Regulation Number 40 of 2004 about National Social Security System (*Sistem Jaminan Sosial Nasional*) and Regulation Number 24 of 2011 about Social Security Agency (*Badan Penyelenggara Jaminan Sosial/ BPJS*).

At the beginning of the implementation in 2014, the number of JKN participants reached 121,6 million lives (49% of the population) with a target of 257 million lives by 2019 (100% of the population). Up to May 2017, JKN participation has reached 176.738.998 lives or equal to 69% of the total population of Indonesia. This number keeps increasing every month until it reaches the target of the entire Indonesian population in 2019. Of all the participants who are registered, participants from the segment of Premium Support Receiver (*Penerima Bantuan Iuran, PBI*) is the dominating participant, as much as 62% or 108.986.892 lives of the total of registered participants. PBI participants are those whose premium is covered by Central Government supported by Local Government (*Badan Penyelenggara Jaminan Sosial (BPJS) Kesehatan*, 2017).

JKN participants who pay the premium are covered for all health service expenses which are divided into three groups of services which are first degree out-patient expenses (*Rawat Jalan Tingkat Pertama, RJTP*), advanced out-patient expenses (*Rawat Jalan Tingkat Lanjut, RJTL*), and advanced in-patient expense (*Rawat Inap Tingkat Lanjut, RITL*). The benefits that are obtained by JKN participants are more comprehensive compared to the benefits and scheme of Regional Healthcare (*Jaminan Kesehatan Daerah, Jamkesda*) which existed prior to JKN. This coverage of health service benefit includes coverage for catastrophic illnesses that are often very costly. Other than that, the recipients of the JKN benefits have access to services in every medical facility (*Fasilitas Kesehatan, Faskes*) owned by both the government and private sector which cooperate with BPJS Health, both in the category of First Degree Medical Facilities such as Community Health Center (*Puskesmas*) and clinics as well as advanced medical facility (hospitals). Other than that, JKN is an effort by the government to give equal opportunity to the poor in obtaining health services from available medical facilities. This is different to the condition of health services in 2004-2005 as mentioned in a study in Yogyakarta (Indonesia) that the poor tend to buy over the counter medicine for flu, fever, diarrhea and breathing difficulty rather than going to a medical facility (Seeberg, Pannarunothai, Padmawati, Trisnantoro, Barua, & Pandav, 2014).

The benefits that are received by JKN participants are quite comprehensive compared to several other *Jamkesda* schemes. The benefits of JKN are comprehensive for all illnesses. This is in line with the assumption that JKN has fulfilled the UHC dimensions which includes: health coverage for everyone (the first dimension), coverage of all illnesses (the second dimension), and a minimum cost burdened to the people, for pre-determined selection of services (Nugraheni, 2015) (Boerma, Evans, Kieny, Eozenou,

Evans, & Wagstaff, 2014). This condition is in line with the goals of UHC that everyone can access high quality health services, to protect everyone from public health risk, and to protect everyone from becoming poor from being sick as a result of paying the cost from personal income (Maeda, Araujo, Cashin, Harris, Ikegami, & Reich, 2014). JKN services also bear the services up to health services for catastrophic illnesses. This bearing of the cost of catastrophic illnesses is the advantage of JKN which is a service that protects everyone in every health condition (Thabrany, 2015). This condition describes the effort of fulfilling health rights for all regardless of their social economic status to obtain health services that they need. The implementation of JKN policy shows that there is an increase of national utilization, but there are still disparities in many areas which are highly varied. These disparities are influenced by among others geographical conditions, availability of resources and medical facilities which become a challenge in implementing JKN in Indonesia.

By considering the background above, there needs to be a study that analyzes the factors that can influence the implementation of JKN policy in achieving UHC target, especially in utilization of in-patient care in Indonesia. This study is aimed to discover the driving factors and obstacles in implementing JKN policy especially in-patient utilization in line with top-down policy perspective of Edwards III's theory which emphasizes four variables which includes communication, bureaucratic structure, resources and disposition.

**2. Materials and Method**

This study used a qualitative approach, in which data was collected through in-depth interviews and literature review on previous studies and statistical data. In-depth interview was conducted in three cities: Makassar (South Sulawesi Province), Jakarta (DKI Jakarta Province), and Ambon (Maluku Province). Based on National Social Economy Survey 2015 (Susenas), after one year of the implementation of JKN, South Sulawesi is the province with a high value of in-patient utilization, which is above the national average, while Maluku has the lowest rate. In-depth interviews were done in South Sulawesi and Maluku in 2016. The informants of the study were employees of the Health Ministry, Local Government, Health Services, hospitals and Healthcare and Social Security Agency in Makassar, Ambon, and Jakarta. List of the informants are mentioned in Table 1.1

Table 1.1 Lists of Research Informants

Informants	
National Level	Local level
Head of Human Resource Department, Ministry of Health Republic of Indonesia	Governor of Maluku Province in Ambon
Senior Advisor on Budgeting, Ministry of Health Republic of Indonesia	Head of Maluku Region of BPJS Health in Makassar
Members of National Social Security Council	Head of Department of Health Maluku Province

Head of Research and Development Center of BPJS Health	Head of Department of Health Ambon City
	Director of Sumber Hidup Hospital in Ambon
	Vice Director of Dr. Haulussy Ambon Hospital
	Head of BPJS Health Region IX in Makassar
	Vice Director Wahidin Sudirohusodo Hospital in Makassar
	Director of Hasanudin University Hospital in Makassar
	Director of Siloam Hospital in Makassar
	Director of Labuang Baji Hospital in Makassar
	Head of Department of Health Makassar City

### 3. Result and Discussion

#### Driving Factors & Obstacles in the Implementation of JKN

The discussion of implementation of healthcare in the scheme of JKN in terms of in-patient service, seen from aspects of the executing institution, instruments and policy strategy, uses Edwards III's theory of implementation as a theoretical framework. Utilization of in-patient is defined as in-patient service in public and private hospitals using examples in South Sulawesi and Maluku provinces. Susenas survey in 2015 showed that South Sulawesi has a high in-patient utilization rate compared to the national average. South Sulawesi, which is in regional 3, is recorded as an area with in-patient utilization value of 19.86, higher than national utilization value (19.64). Meanwhile, Maluku is the province with the lowest utilization value according Susenas 2015. Utilization based on area, placed Maluku in regional 5 with the lowest in-patient utilization value of 9.04 (Pusat Pembiayaan dan Jaminan Kesehatan (PPJK) Kemenkes RI, 2016).

Ease in obtaining medical services was mentioned by several informants in South Sulawesi was the major factoring that increase the utility of in-patient care because the cost of treatment is guaranteed. This ease is admitted to be very influential for the poor because it makes it easy for them in getting health services without paying any expenses. Other than the poor, independent participants (those who pay the premium individually and not supported by the government) also get the benefits of health service coverage.

The increase of participant numbers in South Sulawesi also influences the increase of in-patient utility. Even though, up to now, there is a high number of participants from the PBI segment, which is a significant factor in increasing the JKN participation, people who register as independent participants also increase. This is because people are getting a better understanding of the importance of JKN. The healthcare system enables risk sharing for JKN participants so people are motivated to participate in the JKN program. Several informants admitted that the increase of JKN participants has expanded the utilization of health services, including in-patient service. The coverage of JKN participation in South Sulawesi in 2014 was 49%, while the highest participation coverage in the same year was in South Kalimantan which was 66,3% (Badan Perencanaan Pembangunan Nasional (BAPPENAS), 2015). This comparison of participation coverage shows that the JKN participation coverage of South Sulawesi is very good, considering South

Sulawesi is one of the ten most populous provinces in Indonesia.

In addition, the referral system and availability of facilities in South Sulawesi, especially in Makassar was also a factor in increasing in-patient utility in the area. Informants admitted that Makassar is a referral destination for East Indonesia area; therefore many patients from surrounding areas, including Maluku, are referred to Makassar if they are untreatable or if treatment instrument is not available in their area. This is corroborated by informants from BPJS Health Maluku that the limitation of infrastructure and doctors makes the health service in that area often has to refer the patients to other areas, for example to Makassar, Surabaya, or Jakarta.

From the point of view of availability, the increasing numbers of medical facilities that cooperate with BPJS Health in South Sulawesi has increased the chances of people in getting health services therefore the utilization rate of in-patient care also increases. This hypotheses is confirmed by an informant from BPJS of South Sulawesi that there has been an increase of medical facilities in South Sulawesi since the implementation of JKN, not just in government-owned facilities, but also private facilities that cooperate with BPJS Health in the JKN program.

*“....we see a high utilization rate in South Sulawesi, this is because this province is an industrial province, a highly developed province and it also has a good medical track record in creating doctors who graduated from Hasanudin University’s hospital, which has been established for many years, from these doctor graduates, emerges many hospitals and later on clinics, therefore patients or citizens of South Sulawesi can get easy access to medical care. And geographically, there are no obstacles in reaching these medical facilities.”* (An official from Wahidin Hospital)

Data from Susenas 2015 shows that after the implementation of JKN in Ambon, in-patient utilization has increased, especially among JKN participants who were admitted both as PBI and VIP patients in private hospitals. This is also admitted by informants from private hospitals. There has been an increase in utilization for all types of treatment room since the cooperation between medical facilities and BPJS Health in Ambon.

The absence of geographical obstacles is one of the driving factors for the high in-patient utilization in South Sulawesi. Informants of South Sulawesi BPJS Health expressed that there are no geographical obstacles in accessing health services; with the exception of Pangkep area. This is also supported by socialization and education programs that were carried out which increased the public’s knowledge of the program. So, without geographical obstacles, the public can easily access available services. However, socialization programs are still needed, especially for the medical workforce so they can better understand the referral system and improve claim record management. This is needed to minimize the waiting line at the referral hospital, which can influence the quality of service. Other than the lack of geographical obstacle, South Sulawesi, especially Makassar, also has an innovation, which is homecare service, health service coming to people who need free service.

Different circumstances are found in Maluku. This research has found that in-patient utilization rate in Maluku is the lowest in Indonesia based on Susenas data in 2015. This low in-patient utilization rate in Maluku is mainly influenced by geographical obstacles. Maluku is an archipelago; therefore access to health service is more difficult. Other than that, up to this point the implementation of “coming to the participant” (*meaning healthcare services go to where the patients are*) has not been done optimally so it is yet to solve the problem of geographical access and transportation for the patients. This limited access of archipelagic community is mainly due to problems such as high cost, time and unavailability of medical facilities. Another condition that influences in-patient utilization rate in Maluku is the gap of medical workforce availability.

Maluku consists mostly of islands; therefore access to medical facilities is more difficult. The trip to other islands in search of medical facilities burdens the people in terms of cost and time. Other than that there is still a disparity in medical workforce, for example the rarity of specialists for type C hospitals in Ambon. This condition causes some people, according to informants from Maluku Province Health Service (*Dinas Kesehatan Provinsi Maluku*), prefer not to seek treatment at all, thus, causing utilization rates to be low.

Still related to the disparity of medical workforce, Maluku is not the only area in Indonesia with that problem. A research conducted in the Regency of Lingga, in the Province of Riau, (another archipelagic state) found that there are not enough general practitioners and specialists available (Luti, Hasanbasri, & Lazuardi, 2012). Another research in Natuna Islands, Province of Riau, found that the role of local government is very important in the distribution and dispersion of medical workforce (Syafari, Sulisty, & Kristiani, 2013). Data from the Indonesian Health Profile of 2015 showed that the ratio of physicians to 100.000 inhabitants in the province of Maluku is 18.86. This is higher compared to the ratio of physicians in South Sulawesi, which is 16.91 and also higher than the national rate which is only 16.06. However, this ratio is still far from the ideal target set by the Ministry of Health that has to be reached in 2019, which is 45 physicians per 100.000 inhabitants (Kementerian Kesehatan RI, 2016).

In facing this challenge, Maluku Province Government has compiled island cluster referral system but still faces problems in the implementation especially related to expensive transportations cost. In addition, medical facilities in the regency level (Kecil Island area) do not yet have the required medical equipment and workforce for treating patients.

The problem of limited access due to geographical obstacles is a research finding variable which influences accessibility in obtaining health service. Geographical obstacles and additional cost for transportation are also problems found in other parts of Indonesia. A study of tuberculosis (TB) patients at Kulon Progo Regency, DI Yogyakarta Province, found that during the diagnosis stage, the highest cost component includes in-patient costs, direct medical costs and additional meal costs, however, during the next phase, which is treatment, the cost of meals and trips became the highest cost component compared to

direct medical costs (Ratnawati, 2015).

“... based on my observation, in archipelagic states, the main obstacle is the transportation aspect, for example, when someone in the Puskesmas (local clinic) gets referred to a hospital. Especially in areas where the island does not have a hospital, the island only has the first tier of medical facility, which is Puskesmas. So, in order for the patient to go a hospital, it will take up a lot of their time and money for the transport.” (An official of BPJS Health of Makassar, South Sulawesi)

This condition shows that the annulment of health service cost in JKN scheme does not instantly increase access to health services especially in geographically challenged areas such as Maluku. Geographical obstacles compounded with limited health resources and equipment in several areas in Maluku, are some of the challenges for archipelagic areas. Delayed referrals to better medical facilities can also lower the patient's health condition and possibly increase the number of mortality.

Access to health services in archipelagic areas is indeed a challenge in Indonesia. Informants from Ministry of Health said that the typological differences of archipelagic and land societies are extreme. For example, the island of Java is highly populated but the population is concentrated, meanwhile in areas such as Maluku the population is spread in a vast area. This means medical facility dispersion for the needs of health service must be dealt with according to the condition of each area.

Because of these obstacles, some difficulties in health services are still found such as medicine availability management. A common problem is medicines covered by BPJS Health are not available so patients must buy a different medicine and spend additional cost. The medicine availability management is admitted by informants to be influenced by the budgeting and procurement systems, especially in public hospitals which have to procure medicines at the beginning of the budget year. Therefore, when the medicine is out of stock, it can only be procured during the next budgeting period. From the in-depth interview with an employee of a health service hospital, it was found that the management of the hospital was hindered by an external factor which was the unavailability of medicine in LKPP (*Lembaga Kebijakan Pengadaan Barang dan Jasa Pemerintah*, Government Goods and Service Procurement Policy Institution) and the limitation of budget for health service hospitals.

Another challenge in in-patient service is limited availability of beds in hospitals. This condition shows that an increase in the number of in-patient patients is not necessarily followed by the addition of beds. Data from the Indonesian Health Profile of 2015 showed that the ratio for available beds in the province of Maluku is 1.43. This is lower than the ratio in South Sulawesi, which is 1.51. However these two provinces have a higher ratio compared to the national average, which is only 1.21 (BPJS Kesehatan, 2016). Therefore, in relation to the availability of beds, other than having a high ratio number, the quality of service must also be considered so the value of utilization will increase.

## **The Role of the Executing Institution in JKN Implementation**

The implementation of JKN involves national institutions (Ministry of Health, BPJS Health) and local institutions (Local Government, Health Service, local BPJS Health). This study found that local government has a role in the implementation of JKN and increasing number of participants.. Local government has a role mainly in the integration of Jamkesda (regional healthcare). Local government through Health Service also has a role in supporting and overseeing the implementation of JKN in relation to the referral system. In the execution of the referral system policy, there are some difficulties faced by the local government in relation to overlapping policies between local policies and central government policies. Through Health Service, the local government also has an important role in increasing the quality of health service and in socialization programs. BPJS Health and Health Service have a significant role in increasing the transfer of information from JKN policy to concrete implementation that can be understood by the public. Socialization programs are an example of an effort done to increase the clarity of goals and systems of JKN. In addition, another role that is also determined by Local Government, among others, is optimum health spending allocation in the region, which is a minimum of 10% of the total local budget (APBD). Local government is also responsible in setting up complaint channels and regulations which can oversee violations in the execution of JKN in order to improve the quality of service and ensure that there is no discrimination. In responding the inequality of medical workforce, the innovation of local government in determining additional efforts so public services can be accessed has a key role so a high quality resource is obtained in terms of skills and expertise.

Local government and medical facilities are the frontrunners of service which have key roles in the implementation of JKN, especially in in-patient service both in public and private hospitals. The commitment of local government is very dominant in supporting the increase of participation both through integration of Jamkesda and socialization of JKN in the region. This shows that local government, medical facilities and medical workforce not only have a duty as policy executors, which has a clear mandate from the central government, but are also expected to commit in giving the best service in order to successfully implement JKN policy. Elmore (1978) stated that effective policy implementation is determined not only by clear policy goals but also the performance standard of the sub unit (local government) and also by having an element of control which keeps up with the achievement of the policy goals. Different levels of government should participate in the implementation because they are the units responsible. Implementation of a policy is a series of execution carried out by responsible institution or organization (Jann & Wegrich, 2006). Government (in the national, regional, and local level) is the main institution which is responsible for developing national health policy (Navarro, 2007). Cooperation between levels of government is considered crucial to ensure social service execution in the local level (Fossati, 2016).

In addition, local government is also a governmental organization which is experienced in implementing healthcare after the era of decentralization and has the authority in health. Local government

is an institution which has a historical record in implementing healthcare long before JKN was implemented, for example Jembrana, which is often mentioned as an area which has Jamkesda called *Jaminan Kesehatan Jembrana* (Jembrana Healthcare, JKJ) which provides healthcare for all citizens since 2003 (Aspinall, 2014) (Rosser, Wilson, & Sulistiyanto, 2011). With the development of JKN, Jamkesda, which was previously managed by the local government, is now integrated into the JKN system by giving an opportunity to the local government for cost sharing. At the beginning of the JKN transformation, Jamkesda had a role in covering the gap of people who were not covered by JKN, usually the middle class (not poor, non PNS (public servants), and not able to finance their own healthcare) or also called 'missing middle' (Sparrow, Budiyati, Yumna, Warda, Suryahadi, & Bedi, 2017).

### **Critical Review of Edwards III's Top-down Policy Theory in the Implementation of JKN Policy for In-patient Utilization in Indonesia**

The findings of this study show that Edwards III's theory in policy implementation has not fully covered the real condition in the study area. This is in line with Matland's critic that a construction of a list of variables is not merely enough. Theorists also need specify the condition where the variables are important and the reason why those variables are important in a different setting (Matland, 1995).

Analysis of policy implementation is viewed through Edwards III's theory, which considers four aspects, which are communication, bureaucratic structure, disposition and resources. The findings on the field in terms of bureaucratic structure is that synchronization of JKN implementation is needed between central and local government, especially in setting necessary derivative policies. Variable analysis that influence the implementation of JKN, especially for in-patient service at public and private hospitals, shows that the variables offered by Edwards III do not fully cover the condition of JKN policy implementation in Indonesia. First of all, Edwards III viewed policy implementation through a top-down perspective. This perspective does not cover the role of direct service to society which is performed by doctors, BPJS officers, and other medical workforce at the grassroots level of bureaucrats. This is in line with the critic towards policy implementation theories with a top-down perspective as iterated by Lipsky (1971) that a bottom-up analysis approach to policy implementation is needed. The significant influence of front line staff or grassroots level of bureaucrats needs to be considered in public service when discussing the execution of policy implementation (Lipsky, 1971).

Local government's commitment, medical facilities, and medical workforce show that there is a political process that is not just administrative in policy implementation. A top-down implementation theory views policy implementation only as an administrative process without any regard to political aspects or efforts to overcome those political obstacles (Berman, 1978). Here, political aspect is a process that is carried out by local government in implementing the policy, which is usually influenced by the commitment

of the leader and other necessary decisions so that policy implementation will be successful, for example the commitment to integrate Jamkesda, the initiative for budget allocation, forming an executive team, and so on. The implementation of JKN in in-patient service at public and private hospitals in Indonesia shows that this policy must have political support in order to achieve UHC target in 2019

Other evidence strengthens that the *top-down policy* perspective of Edwards III's theory must also be supported by the lower levels of executive institutions or grassroots level of bureaucrats. This shows that the perspective of top-down policy must also be complemented with a bottom-up perspective, especially for countries with a decentralized system like Indonesia, because the local government has the authority to decide health services issues. This is reflected in local and gubernatorial regulations in the field of health service and healthcare as derivative regulations of UU SJSN and UU BPJS in Indonesia, and also supported by Regulation in Local Government in 1999. Several local governments already have local healthcare systems which flourish during the implementation of JKN. That is why it is important to consider bottom-up perspective as an effort to integrate local healthcare system into the JKN system.

Bottom-up perspective shows that in a policy there must be an understanding of the role of grassroots level bureaucrats as officials who have control in the implementation process. In policy implementation, grassroots level bureaucrats are actors who interact directly with the people. Empirical evidence shows that in the implementation process, every public official who execute the policy will do it according to the regulations of the executing institution and their own personal characteristics (Hill & Hupe, 2002). A gap between the policy maker and the official who executes the policy can hinder the implementation of this policy. This study also finds that there are variables that are not covered in the top-down perspective, but can be highlighted in the bottom-up perspective, including organizations other than the executing organization (not the government). A variable found in this research but is not included in Edwards III's theory of policy implementation is people's participation or *gotong-royong* (cooperation) which is a principle of JKN policy. *Gotong-royong* is the principle of SJSN execution according the mandate in Regulation Number 40 of 2004 and Regulation Number 24 of 2011. *Gotong-royong* is a principle of togetherness among participants in bearing the cost of social security with the obligation of paying the premium according to their level of income. This condition enables people who are healthy to subsidize for people who are sick, the rich helps the poor.

*Gotong-royong* is in line with previous researches that said that other than grassroots level bureaucrats, other factors such as organizational implementation machinery, or in this case community organization network, can highly determine the implementation of policy (Lynn, Heinrich, and Hill 2000). This is proven by a trend of *gotong-royong* of a variety of stake holders in health financing. One example is an effort done by BPJS to cooperate with BAZNAS (*Badan Amil Zakat Nasional*, National Tithing Organization) in giving opportunity to the well-off who wants to help by donating premium to the less fortunate or the poor. The target of this program is non PBI class 3 benefit recipients who have not yet paid

of their premium for at least 3 months and are participants of PBPU category (*Peserta Bukan Penerima Upah*, participants who are not paid for by the government). BAZNAS is an official body that was established after Presidential Decree Number 8 of 2001 with the task and function of gathering and distributing *zakat*, *infaq*, and *sedakah* (Muslim tithing and charity) at the national level ((BAZNAS), 2017). In this case, the principle of *gotong-royong* which is based on religious values in the community can be the determinant of the success of the implementation of JKN program in Indonesia. This finding is in line with the development the concept of government to governance. Governance emphasizes more on the role of the people both individually and as an organization in various forms in the entire process of policy from the formation until the evaluation (Brikenhoff & Johnson, 2008). That is why it is important to not only consider the government but also non-governmental actors and their interaction with the government in the process of policy implementation (Frishtak, 1994).

Cooperation (*gotong-royong*) is not only needed in financing, but it also needed among the stakeholders in implementing JKN. The active role of medical workforce, medical facilities, central government, local government, businesses, and public figures are highly needed in the implementation of JKN. Research results in South Sulawesi and Maluku shows that the active role of stakeholders is an important determinant in supporting policy implementation. This can be seen in the effort of socialization of JKN program which is mainly done by Health Service in cooperation with BPJS Health in South Sulawesi in delivering JKN programs.

The findings in Maluku also show that the role of non-governmental/ private sector is helpful in driving the success of this program. One of the efforts done by the private sector, in cooperation with Maluku Province Local Government, is giving out scholarships to medical workforce from the region so they can work in the medical facilities built in Maluku. This can help support the effort to increase the number of medical workforce availability which is limited in that area. This active participation is also seen from the increasing number of medical facilities both public and private which are registered as partners of BPJS Health to admit JKN patients. Up to May 2017, with the number of JKN-KIS participants of 177 million lives, BPJS Health also has cooperated with about 26.000 medical facilities, both First Degree Medical Facilities (Health Centers, Pratama Clinics, Private Practice, and so on) and Advanced Referral Medical Facilities (Hospital, Pharmacy, Optician, and so on) which are spread all across Indonesia.

Participation both in Maluku and South Sulawesi shows that social organizations, religion-based social organizations, and private sectors are highly needed in supporting JKN policy. Active participation from the public is not limited to not only creating the policy but also in the implementation stage and this shows the degree of citizen power (Antoft & Novak, 1998) (Arnstein, 1969). The participation is not only in an active role in finding information but also in contributing (Mc Gee & Norton, 2000).

#### **4. Conclusion**

This research found that driving factors influencing in-patient utilization in JKN implementation are easier access in obtaining health care and medical facilities, the increase of JKN participant number, South Sulawesi being the destination for medical facility referral in East Indonesia, the growing number of medical facilities, no significant geographical challenges, and commitment support from the local government. Meanwhile, the main obstacles that can affect the implementation are due to geographical challenge, disparity of health workers, and lack of adequate health service facilities.

Based on the critical review of Edwards III's theory, it can be concluded that in the implementation of JKN policy, the perspective of a top-down policy in the theory cannot be applied singularly and the perspective of a bottom-up policy must also be considered. JKN policy in Indonesia is an example of a policy that combines the two perspectives by emphasizing on the factor of local wisdom in the form of cooperation (*gotong-royong* principle) in the execution. Therefore, in the implementation of a policy, especially one that requires the involvement of the society in a large population, additional variables needs to be considered, in this case the variable of *gotong-royong* which is not covered in Edwards III's theory. The principle of *gotong-royong* in JKN is implemented in the aspect of financing, socialization, and health service which shows increasing trend of the public's participation in supporting the success of this policy. This is proven by the increased number of JKN participants from 121 million at the beginning of the implementation in 2014 to 177,5 million in May 2017 from the total target of 250 million, which will be achieved in 2019 (*Universal Health Coverage/ UHC*).

#### **Authors Contribution**

The first authors had made substantial contributions to conception, design, data collection, analysis and interpretation of data; drafting the article, revising it critically for important intellectual content; and final approval of the version to be published. The second, third, fourth and fifth author had given substantial advice to the first author in developing concept, methodology, data collection, and discussion of the content.

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# VOLTAGE LEVEL SHIFTER USING MODIFIED WILSON CURRENT MIRROR AND ITS APPLICATION

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**Abstract:** This describes the architecture of voltage level shifter and an application of voltage level shifter. Voltage level shifter plays an important role in circuits with multi-supply. Level shifter are used in between blocks for voltage level shifting. The proposed level shifter converts sub-threshold voltage level to supply voltage with increased speed and low power consumption. The multi-threshold voltage CMOS technique is used in the design of voltage level shifter in order to reduce delay and power consumption. This design has been implemented in 180nm, 90nm and 45nm technologies in Cadence virtuoso. The propagation delay, power consumption is verified.

**Keywords-** CMOS,nMOS, pMOS, voltage level shifter.

## I. INTRODUCTION

As , the size of electronics devices goes on decreasing and , the demand of battery-operated devices like phones, laptops etc is increasing, power consumption is the

amount of power consumed by the device. Power consumption is of two types- static and dynamic power consumption. Static power consumption is due to leakage current in the circuit. And , dynamic power consumption is due to charging and discharging of load capacitors. Dynamic power consumption can be reduced by reducing supply voltage. Delay and power consumption is main concern. Delay can be reduced by increasing the supply voltage but increase in supply voltage increases power consumption.

Now-a-days, in a small area ,larger circuits are implemented. To avoid the problem of delay, multiple power supply is used. The circuit with multiple supply is divided into parts and each part is applied with individual supply to reduce delay in larger circuits.

As ,implementing individual power supply in multi-supply circuits increases the size of the circuits and makes it clumsy. So, voltage level shifter is used between blocks with more speed and less power consumption is implemented.

## II. VOLTAGE LEVEL SHIFTER

### A. Proposed design

This level shifter uses a Modified Wilson Current Mirror and an inverter between two NMOS. The operation is as follows, when input is high, MN1 and MN2 are on and off respectively. MP1 goes off and MP2 is on and output is taken as high. When input is low, MN1 is off and MN2 goes on making MP1 and MP2 on and off respectively.

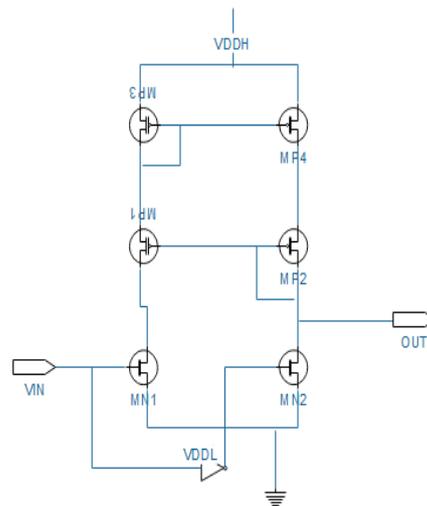


Fig 1: Proposed voltage level shifter

### B. Multi-supply design

In order to verify the working of the proposed level shifter, it is implemented in multi-supply design. This application is composed of three blocks- Half-adder voltage level shifter and D- Flip flops.

The inputs are applied to half-adder . The half-adder provides two outputs- SUM and CARRY. The SUM is allowed to one voltage level shifter and CARRY to another. The level shifter converts the voltage range from 1v to 3v. Then ,the outputs are applied to D-Flip flop for storing the data. As Flip-flops can store only one bit of data. So, here two flip flops are used. The operation is explained as follows-

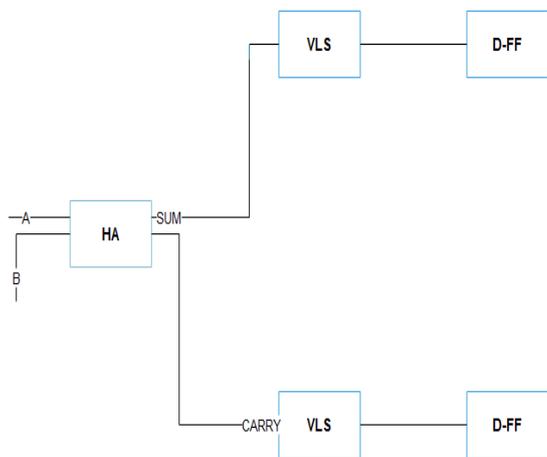


Fig 2: Block Diagram of Multi-Supply design

1) Half-adder

Half-adder is a combinational circuit that performs addition operation. It has two inputs and two outputs. Here, half-adder operates at 1v supply voltage. It consists of one XOR gate and one AND gate.

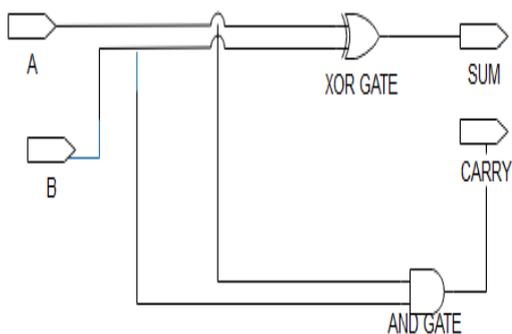


Fig 3: Half-adder circuit

The CARRY bit is high, only if both the inputs are high. And , the SUM is high , when the inputs are not same in other words, when one input is high and the other is low, the SUM is high.. this output is given to the Voltage level shifter.

2) Voltage level shifter

The output of half-adder is given to the voltage level shifters. The SUM is applied to one level shifter and CARRY to the other. The voltage level shifter shifts the voltage level from 1v to 3v. The D-Flip flop operates at 3v supply.

3) D- FLIP FLOP

The D-Flip flop comprises of four NAND gates and one inverter. It is used for storing data. It is also termed as Delay flip flop because it applies some delay at the output. It operates at 3v supply.

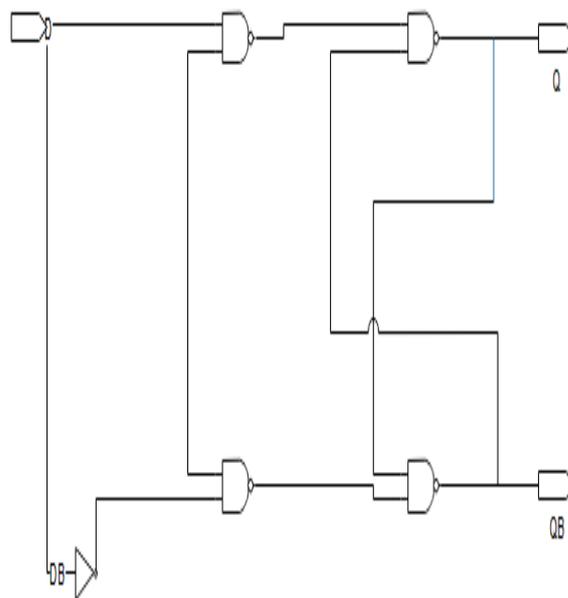


Fig 4. D-Flip flop circuit

When input to half-adder is applied (a=1, b=1) then, SUM=0, CARRY=1 for half-adder as, the half adder operates at 1v supply the output voltage range is also at 1v. this output is applied to two different level shifters. SUM is applied to on level shifter and CARRY to other for level shifting. The output of level shifter is at 3v supply. The output of first level shifter is applied to one D-Flip flop and CARRY to other.

III. SIMULATION RESULTS

A. Proposed design

The proposed level shifter is implemented at 180nm, 90nm and 45nm technologies in Cadence virtuoso simulator. The delay , power consumption are verified. Area is calculated using layout.

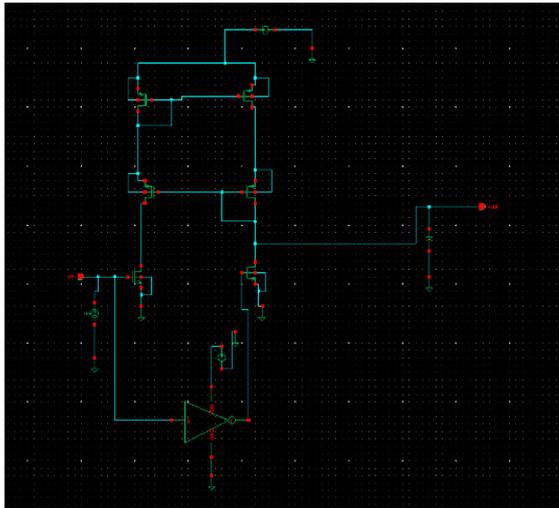


Fig 5. Schematic of proposed level shifter

It operates at VDDL=1V and VDDH=3v. the schematic is implemented at 180nm technology in Cadence virtuoso simulator.

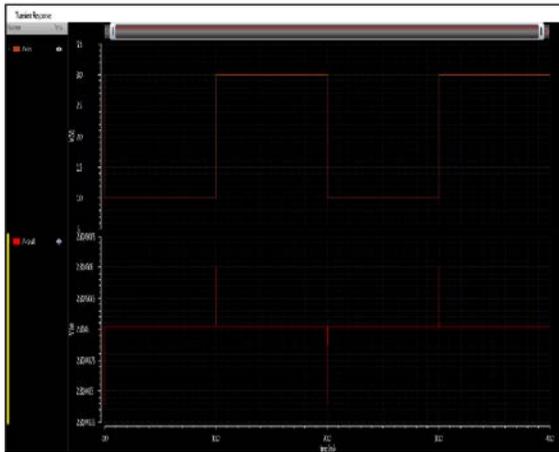


Fig 6. Waveform of proposed design

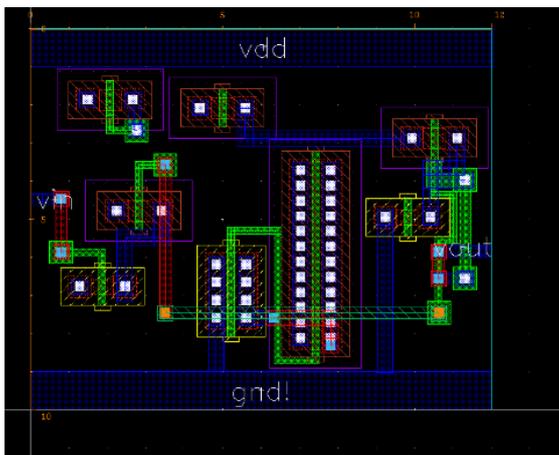


Fig 7. Layout of proposed design

**TABLE I**

**COMPARATIVE SIMULATION RESULTS SHOWING PROPAGATION DELAY AT DIFFERENT TECHNOLOGIES**

AT VDDH=3V, VDDL=1V

Level shifter	180nm	90nm	45nm
Proposed level shifter	1.56 *10 <sup>-9</sup>	5.68* 10 <sup>-12</sup>	4.49* 10 <sup>-12</sup>

**TABLE II**

**COMPARATIVE RESULTS SHOWING POWER CONSUMPTION OF PROPOSED DESIGN AT DIFFERENT TECHNOLOGIES**

AT VDDH=3V, VDDL=1V

Level shifter	180nm	90nm	45nm
Proposed level shifter	145.9* 10 <sup>-9</sup>	126.7* 10 <sup>-9</sup>	102.2* 10 <sup>-9</sup>

**TABLE-III**

**COMPARATIVE SIMULATION RESULTS SHOWING PROPAGATION DELAY AT DIFFERENT TECHNOLOGIES**

VDDH= 1V, VDDL=0.2V

Level shifter	180nm	90nm	45nm
Proposed level shifter	3.23 *10 <sup>-9</sup>	1.20*10 <sup>-11</sup>	5.79* 10 <sup>-11</sup>

**TABLE IV**

**COMPARATIVE RESULTS SHOWING POWER CONSUMPTION OF PROPOSED DESIGN AT DIFFERENT TECHNOLOGIES**

AT VDDH=1V, VDDL=0.2V

Level shifter	180nm	90nm	45nm
Proposed	98.0*	55.7*	45.65* 10 <sup>7</sup>

level shifter	$10^{-9}$	$10^{-11}$	$10^{-12}$
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**TABLE V**

COMPARATIVE RESULTS SHOWING AREA OF PROPOSED DESIGN AT DIFFERENT TECHNOLOGIES

Level shifter	180nm	90nm	45nm
Proposed level shifter	120um <sup>2</sup>	20um <sup>2</sup>	9um <sup>2</sup>

*B. Multi-Supply design*

Fig 8 and 9 shows the simulated waveform for half-adder and D-Flip flop. In Fig 8, the two inputs to half-adder are A and B. The operating voltage of half-adder is 1v so we get output SUM and CARRY in 1v supply. When both the inputs are high, we get CARRY as high. For unequal input bits the SUM is high. In Fig 9, input is applied at D and clock pulse is applied at CLK and output is seen. The output is obtained at Q which is similar to the input signal with some delay.

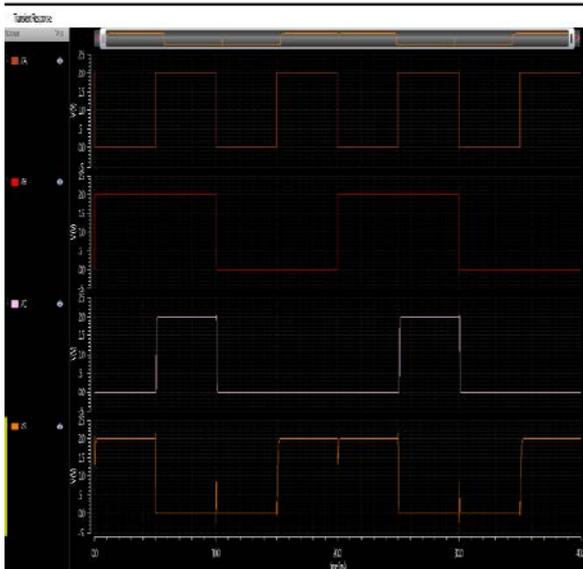


Fig 8. Simulated waveform of Half-adder

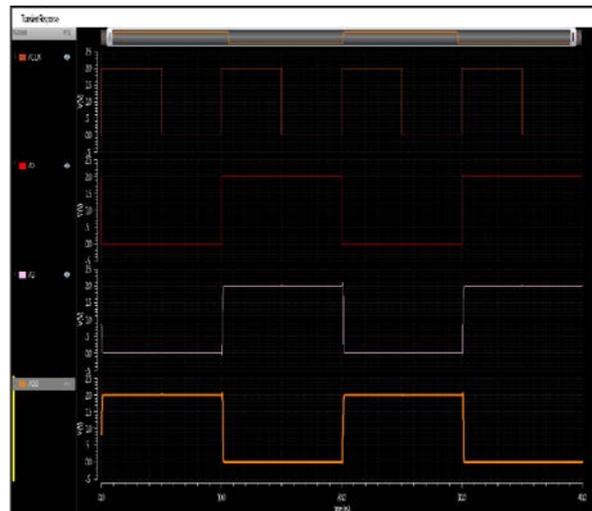


Fig 9. Simulated waveform of D-Flip flop

Fig.10 represents the simulated waveform for multi-supply design. The input signal is applied to half-adder, its output is applied to voltage level shifter for voltage level shifting. The output from the level shifter is again applied to D-Flip flop.

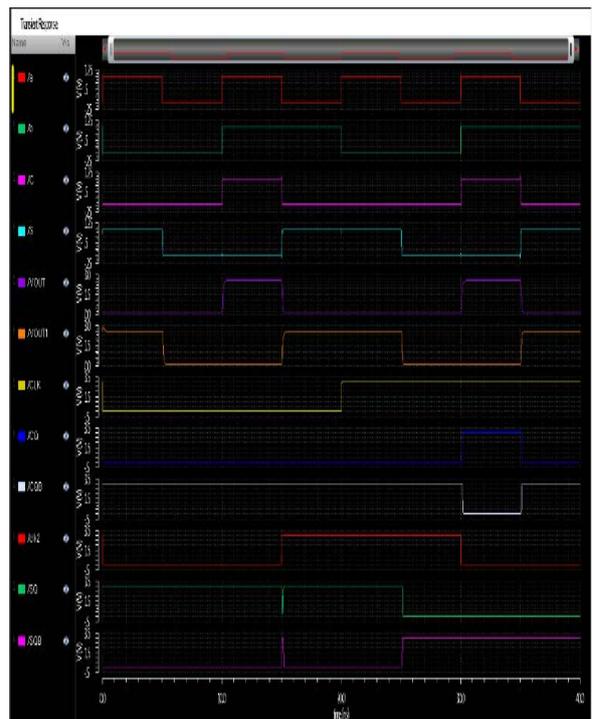


Fig 10. Simulated waveform for multi-supply design

**IV . CONCLUSION**

The proposed voltage level shifter is able to convert one voltage range to the other. As, voltage level shifter is a circuit which is used as a intermediate between blocks with different supply voltages. The efficiency of proposed level shifter is

verified at 180nm, 90nm and 45nm technologies in Cadence virtuoso simulator. Application of voltage level shifter is also presented in this paper, which explores the efficiency of level shifter.

## ACKNOWLEDGEMENT

I am very grateful to my guide, my parents and my friends for supporting me and helping me complete this work.

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# Spatio-Temporal Analysis of Kidnapping and Abduction of Women in Chandigarh

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**Abstract-** In this paper, an attempt has made to study the spatial and temporal pattern of Kidnapping and abduction of women in Chandigarh. The geography is the study of areal variation and distribution. To fulfill the requirement and provide a geographical base to this study, it is necessary to explain the spatial pattern of crime against women. The ward, town and village wise map of Chandigarh used to draw the crime rate of Kidnapping and abduction of women. The temporal trends of kidnapping and abduction of women are showing variation and these variation depends upon many factors like socio-culture, economic development, population growth by natural as well as through migration, female literacy etc. In this paper hot spot also used, which plays an important role in identification of crime prone areas. Hotspots also help to generate the policies for prone areas.

**Index Terms-** Kidnapping and abduction of women in Chandigarh; Spatial Analysis; Temporal Analysis; Hot-Spots Analysis

## INTRODUCTION

The present research work “Spatio-Temporal Analysis of kidnapping and abduction of women in Chandigarh” is carried out to study the spatio-temporal pattern of kidnapping and abduction of women. It varies from class to class, culture to culture and society to society. Women of all age groups are due victims of crime and violence against them. The sexual violence and crime against women are not new in Indian society.

Women are socially sensitive and moulded. They do not speak in public and not share or report most of the physical and mental violence crime against them. The increasing kidnapping and abduction of women incidents show the materialistic approach and patriarchal mindset of society.

According to Crime Statistic Report of National Crime Record Bureau (N.C.R.B) 2015:

- In every eighth minute a kidnapping and abduction of women or girl committed in India where as in Haryana it happens after every 4<sup>th</sup> hour and in Chandigarh it occurs in every 2<sup>nd</sup> day.
- Secondly, the rate of kidnapping and abduction of women or girl which is nearly three & half times higher as compare to the national rate of kidnapping and abduction of women or girl.

The objectives of the study are:

- 1) To examine the spatial patterns of Kidnapping and abduction of women in Chandigarh.

- 2) To analyse the temporal trends of Kidnapping and abduction of women in Chandigarh
- 3) To identify the Hot- Spot and Prone Areas of Kidnapping and abduction of women in Chandigarh.

## RESEARCH METHODS

### DATA SOURCE

This study based on secondary data collected from various sources. The data of the socio-economic factors has been obtained from, census report of 2001 and 2011. The required data regarding location and types of rape for 2005, 2010 and 2015 has collected from the Chandigarh Police Station and Police Headquarter.

### METHODOLOGY

$$\text{Crime Rate} = CR_i = \frac{CX_i}{TFP_i} \times 100000$$

Where:  $CR_i$  = Rate of Crime 'X' in Wards I.

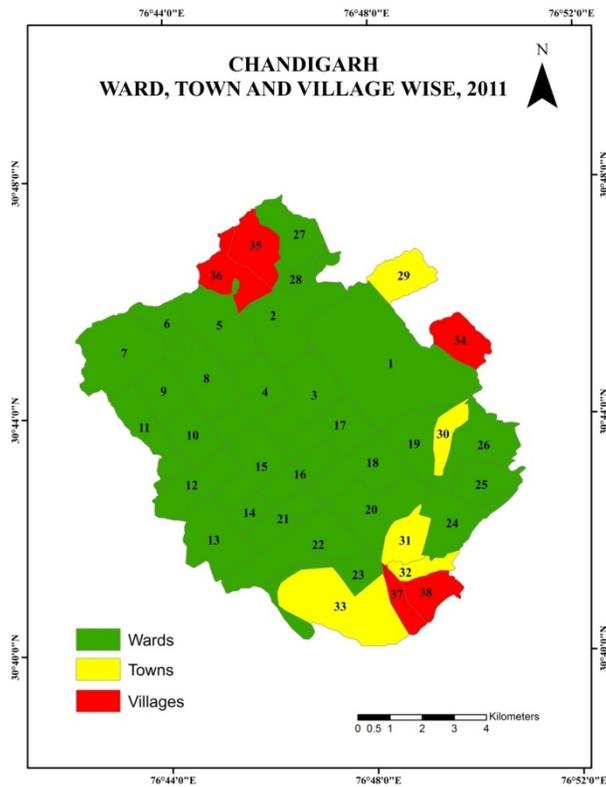
$CX_i$  = Crime 'X' in Wards I.

$TFP_i$  = Total Female Population in Wards I.

An attempts has made to get spatial patterns of crime, the processed information represents through statistical diagrams and has been drawn map using suitable cartographic techniques. The Arc GIS Version 9.3 used generating maps of Chandigarh during the years 2005, 2010 and 2015. Appropriate tables, graphs and charts used to present the trends of rape.

### STUDY AREA

The study area lies between 30.40° North to 30.48° North in Latitude and 76.42° East to 76.51° East in Longitude. The study area Chandigarh is a union territory of India that serves as the joint capital of the states of Haryana and Punjab. It is located near the foothills of the Shivalik range of the Himalayas in northwest India. It covers an area of approximately 114 km<sup>2</sup>, out of the total area i.e. 114 km<sup>2</sup>, 109.53 km<sup>2</sup> is urban area and only area of 4.47 km<sup>2</sup> comprises of rural area. The study area lies between 30° 40' to 30° 48' North Latitude and 76° 42' to 76° 51' East Longitude. It has an average elevation of 321 metres (1053 ft. ). It situated in the northern plains, and vast fertile flat land. Bhabar is located in the northeast and rest of the area is a terai belt. Its surrounding districts are Mohali, Patiala and Roopnagar in Punjab, Panchkula and Ambala in Haryana.



### RESULT, DISCUSSION AND FINDING

#### The section 359-373 of the Indian Penal Code gives the legal definition of Kidnapping and Abduction:

It is more serious problem than rape. In case of kidnapping and abduction of women, they sexually abused as well as kept in captivity. According to IPC kidnapping and Abduction is under Section 359 to 373, Kidnapping is of two types:

First, kidnapping from India, and

Second, one is kidnapping from lawful guardianship

1. Kidnapping from India

Whoever conveys any person beyond the limits of India without the consent of that person, or of some person who legally authorized to give consent on behalf of that person, said to kidnap that person from India.

2. "Kidnapping" from lawful guardianship

Taking or enticing away a minor or a person of unsound mind.

Such minor must be under 16 years of age, if a male, or under 18 years of age, if a female,

c) The taking or enticing must be out of the keeping of the lawful guardian of such minor or person of unsound mind; and

d) Such taking or enticing must be without the consent of such guardian.

#### Section 362 IPC defines "Abduction"

Firstly, Forcible compulsion or inducement by deceitful means and

Secondly, he objects of such compulsion or inducement must be going of a person from any place.

Abduction differs from kidnapping from guardianship. Kidnapping from guardianship is committed only in respect of

minor or person of unsound mind, whereas abduction in respect of any person. In kidnapping, the person kidnapped removed out of lawful guardianship. In abduction, this is not necessary. In kidnapping the minor or the person of unsound mind simply taken away or enticed to go with the kidnapper, in abduction force, compulsion or deceitful means are used.

In kidnapping consent of the person moved, if freely and voluntarily given condones it. In kidnapping, the intent of the offender is irrelevant but in abduction, it is the all-important factor. Kidnapping from lawful guardianship is not a continuing offence. As soon as the minor is removed out of custody of his or her guardian, the offence is completed, but a person is being abducted not only when he is first taken from any place but also when he is removed from one place to another. In kidnapping from India, there is removal of a person outside India without his consent or of someone authorized to give it. He may or may not be a minor or of unsound mind.

### KIDNAPPING AND ABDUCTION IN INDIA

Data of N.C.R.B Report 2015, shows that in year 2015 maximum numbers of Kidnapping and Abduction cases were registered in the state of Uttar Pradesh (10,156 cases) followed by Bihar (5,158 ) Maharashtra (5,096), Assam (5,039) and Madhya Pradesh (4,547). These five states constitute 50.60 percent of the total Kidnapping and Abduction cases reported in the country as a whole. Whereas in terms of rate, the national Kidnapping and Abduction rate is 9.8 Among the states, Assam (32.1) ranked first followed by Arunachal Pradesh (20.7), Haryana (18.7), Jammu and Kashmir (18.2) and Orissa (12.4) and in case of union territories, the Kidnapping and Abduction rate was 46.3 in Delhi followed by Chandigarh (10.1) and Daman and Diu (12.3).

### SPATIAL PATTERN OF KIDNAPPING AND ABDUCTION IN CHANDIGARH IN 2005

A total 22 wards and 22 villages are analysed here. Incidence of Kidnapping and Abduction at the wards and villages level shows that in the year 2005, maximum numbers of such cases were reported in the Ward No. 17 (11 cases) followed by Ward No. 15 (5 cases), Ward No. 1,8,19 and village Hallo Majra have (3). These five Wards and one village constitute 62.8 percent of the total case registered in Chandigarh as a whole. Whereas in terms of rate, the rate of Kidnapping and Abduction during 2005 shows that the Ward No. 17 has (97.3) followed by Mauli Jagran (72), Dadu Majra (69.3) and Hallo Majra (68.7). The average crime rate of Kidnapping and Abduction in Chandigarh in 2005 was 11.4.

The geographical pattern of Kidnapping and Abduction in the year 2005 shows that the South Western, South Eastern and the Northern Wards including (Ward No. 17, Mauli Jagran, Dadu Majra and Hallo Majra) shows higher crime rate, the Central part shows moderate rate and the rest wards shows lower crime rate of Kidnapping and Abduction.

### SPATIAL PATTERN OF KIDNAPPING AND ABDUCTION IN CHANDIGARH IN 2010

A total 22 wards and 22 villages are analysed here. Incidence of Kidnapping and Abduction at the wards and villages level shows that in the year 2010, maximum numbers of such cases were reported in the Ward No. 19 (4 cases) followed by Ward No.

15,17,18 (3 cases) and village Hallo Majra have (3). These four Wards constitute 57 percent of the total case registered in the Chandigarh as a whole. Whereas, the rate of Kidnapping and Abduction of women in Chandigarh during 2010, highest i.e. 49.2 in Palsora ranked first followed by Maloya (44.3), Ward No. 17 (26.5) and Ward No. 18 (22.6). The average crime rate of Kidnapping and Abduction in Chandigarh in 2010 was 7.1. The geographical pattern of Kidnapping and Abduction in the year 2010 shows that the South Western and South Eastern Wards including (Ward No. 17, 18, Palsora and Maloya) shows higher crime rate, the Northern and the North Eastern part shows moderate rate and the rest wards shows lower crime rate of Kidnapping and Abduction.

### SPATIAL PATTERN OF KIDNAPPING AND ABDUCTION IN CHANDIGARH IN 2015

A total 28 wards, 5 towns and 5 villages are analysed here. Incidence of Kidnapping and Abduction at the wards and villages level shows that in the year 2015, maximum numbers of such cases were reported in the Ward No. 12 (14 cases). It were followed by Dhanas (12), Ward No. 23 (11) and Ward No. 14, 20, 25 have (10). These five Wards and one village constitute 40 percent of the total case registered in the Chandigarh as a whole. Whereas in terms of rate, the rate of Kidnapping and Abduction during 2015, the village Dhanas has (423.1) followed by Muli Jagran (201.2), Kaimbwala (148.5) and Khuda Alisher (97.1) the average crime rate of Kidnapping and Abduction in Chandigarh was 34.8 in Chandigarh.

The geographical pattern of Kidnapping and Abduction in the year 2015 shows that the Northern and South Eastern Wards including (Dhanas, Muli Jagran, Kaimbwala, Khuda Alisher) shows higher crime rate, the Central part shows moderate rate and the rest wards shows lower crime rate of Kidnapping and Abduction.

### CHANGING PATTERN AND CAUSES OF KIDNAPPING AND ABDUCTION OF WOMEN RATE IN CHANDIGARH FROM 2005-2015

In the year 2005, there is lower rate of kidnapping and abduction of women in central parts of Chandigarh but the scenario has changed in 2010 and 2015, it shifted from the central side and separate in whole Chandigarh.

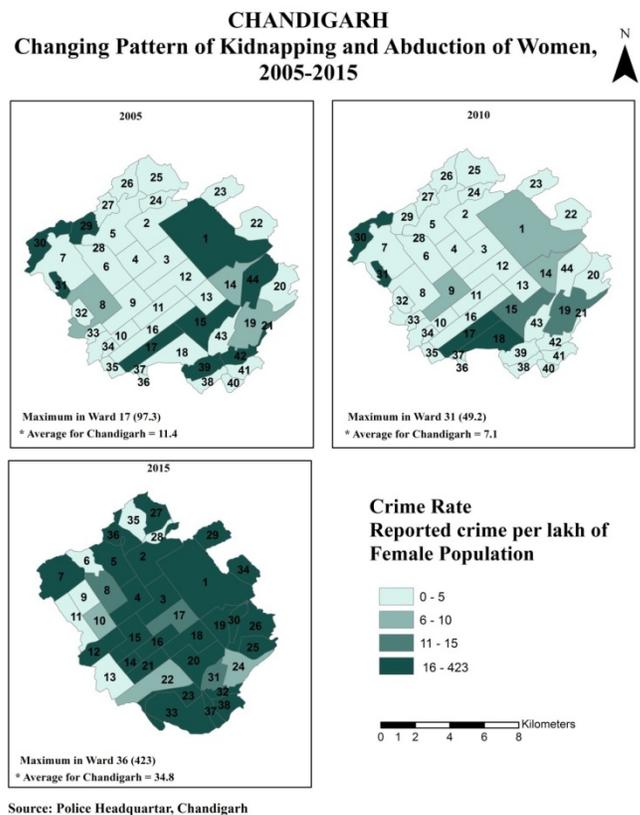
The major factors responsible for higher rate of Kidnapping and Abduction of Women are following separation from the family, small size of household, lower sex ratio, lower percentage of working women population, low level of female literacy, low percentage of house ownership, low level of basic amenities availability in households, sex selected immigration and materialistic approach towards women. Kidnapping and Abduction of Women higher rate found in following areas including Dhanas, Muli Jagran, Kaimbwala, Dadu Majra, Mani Majra and Ward No 17.

### TEMPORAL TRENDS OF KIDNAPPING AND ABDUCTION OF WOMEN IN INDIA

The analysis of Kidnapping and Abduction of women in India from 1991 to 2015 shows variation across the time. The maximum numbers of Kidnapping and Abduction of women

incident are found in year 2015 (59,277 cases) followed by year 2014 (57,311), 2013 (51,881) and 2012 (38,262) however lowest in year 1993 (11,837), 1992 (12,077), 1991 (12,300) and 1994 (12,998). From 1991, it was increasing continuously, however, after 2013, its trends increased tremendously.

Whereas, in case of Kidnapping and Abduction of women rate the year 2015 shows the highest i.e. 10.1 followed by 2014 (9.8), 2013 (8.8), and 2012 (6.5) however the year 2003 shows the lowest Kidnapping and Abduction of women rate 2.7 followed by 1993(2.9), 1991, 1992 and 2000 have (3.0).



### TEMPORAL TRENDS OF KIDNAPPING AND ABDUCTION OF WOMEN IN HARYANA

The reported cases of Kidnapping and Abduction of women in Haryana show variation across the time. The maximum numbers of Kidnapping and Abduction of women incident are found in year 2015 (2,336 cases) followed by year 2013 (1,957), 2014 (1,922) and 2012 (900), however, lowest in year 1991 (158), 1993 (180) and 1992 (228).

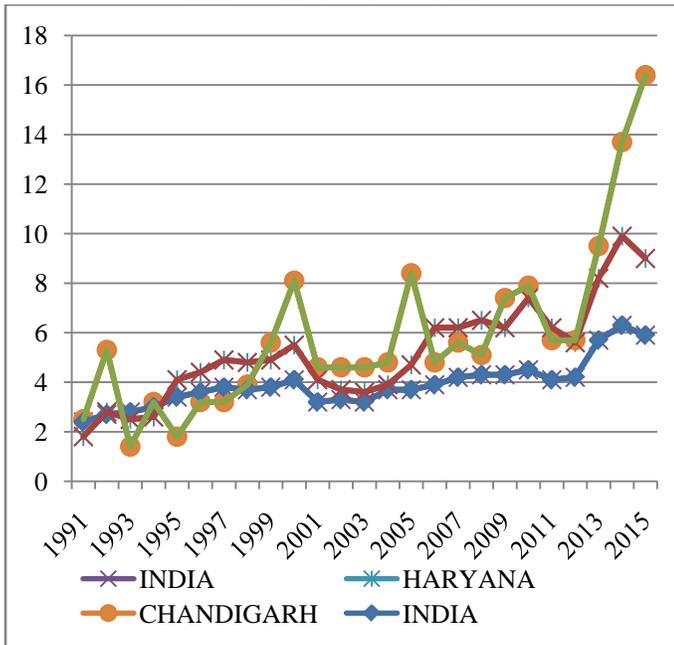
Whereas, in case of Kidnapping and Abduction of women rate, the year 2015 shows the highest Kidnapping and Abduction of women rate i.e. 19.7 followed by 2013 (16.5), 2014 (16.2), and 2012 (7.6). However, the year 1991 shows the lowest Kidnapping and Abduction of women rate 2.1 followed by 1993 (2.4), 2003 (2.8), 2001, 2002, 2004 and 1992 (3).

### TEMPORAL TRENDS OF KIDNAPPING AND ABDUCTION OF WOMEN IN CHANDIGARH

The trends of Kidnapping and Abduction of women in Chandigarh are not showing uniform pattern, there are up and

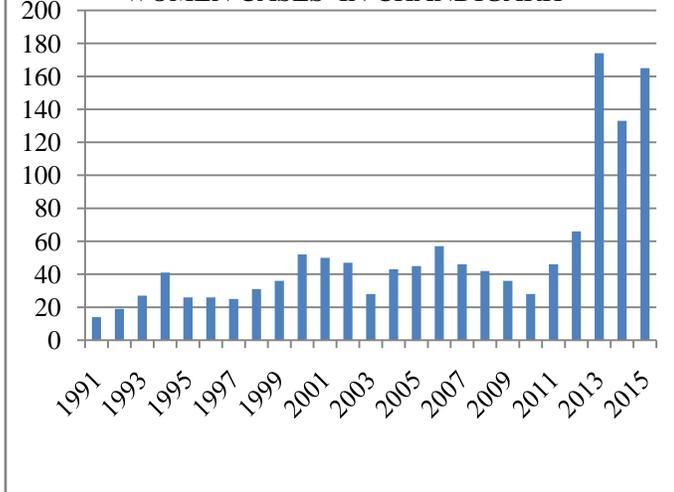
down in crime rate but it is continuously increasing trends as shown in the diagram. Incidences of Kidnapping and Abduction of women in Chandigarh show variation across the time. The maximum numbers of Kidnapping and Abduction of women incident are found in year 2013 (174 cases) followed by year 2015 (165), 2014 (133) and 2012 (66) however lowest in year 1991 (14), 1992 (19), 1997 (25) and 1996 (26 cases). Whereas, in case of Kidnapping and Abduction of women rate, the highest Kidnapping and Abduction of women rate i.e. 36.6 in 2013 followed by 2015 (34.8), 2014 (28), and 2000 (18.3). However, the lowest Kidnapping and Abduction of women rate i.e. 4.9 in 1991 followed by 1992 (6.7), 2010 and 2003 (7.1).

TEMPORAL TRENDS OF KIDNAPPING AND ABDUCTION OF WOMEN



Source: N.C.R.B. Reports from 1991-2015.

KIDNAPPING AND ABDUCTION OF WOMEN CASES IN CHANDIGARH



Source: N.C.R.B. Reports from 1991-2015.

KIDNAPPING AND ABDUCTION OF WOMEN INCIDENT AND RATE						
YEARS	INDIA		HARYANA		CHANDIGARH	
	INCIDENT	RATE	INCIDENT	RATE	INCIDENT	RATE
1991	12300	3	158	2.1	14	4.9
1992	12077	3	228	3	19	6.7
1993	11837	2.9	180	2.4	27	9.5
1994	12998	3.2	240	3.1	41	14.5
1995	14063	3.5	297	3.9	26	9.2
1996	14877	3.7	307	4	26	9.2
1997	15617	3.8	291	3.8	25	8.8
1998	16351	4	318	4.2	31	10.9
1999	15962	3.9	350	4.6	36	12.7
2000	15023	3.7	299	3.9	52	18.3
2001	14645	3	297	3	50	12.7
2002	14506	2.9	290	3	47	11.9
2003	13296	2.7	271	2.8	28	7.1
2004	15578	3.1	292	3	43	10.9
2005	15750	3.2	344	3.5	45	11.4
2006	17414	3.5	431	4.4	57	14.5
2007	20416	4.1	554	4.4	46	11.7
2008	22939	4.6	644	6.6	42	10.7
2009	25741	5.2	659	6.7	36	9.1
2010	29795	6	714	7.3	28	7.1
2011	35565	6.1	733	6.2	46	9.7
2012	38262	6.5	900	7.6	66	13.9
2013	51881	8.8	1957	16.5	174	36.6
2014	57311	9.8	1922	16.2	133	28
2015	59277	10.1	2336	19.7	165	34.8

Source: N.C.R.B. Reports from 1991-2015.

Total 1303 reported cases of kidnapping and abduction of women are filed in Chandigarh from 1991-2015. The trends of kidnapping and abduction of women cases is not uniform. With respect of time period, the year 2013 shows the highest numbers of case of Kidnapping. The year 1991 shows the least number of reported cases of kidnapping and abduction of women in Chandigarh. Reasons behind this have immigration and natural growth.

#### Hot Spot of Kidnapping and Abduction of Women

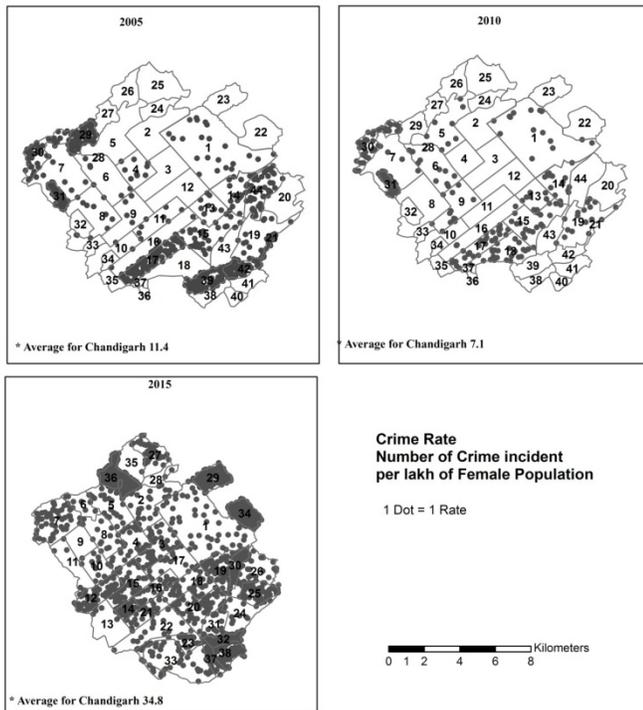
Kidnapping and abduction hot spot recorded a fast changing scenario during 2005-2015 in Chandigarh. Sharp decline in rate of reported cases of kidnapping and abduction is mainly responsible for this. The rate of reported incidence of kidnapping and abduction against women, which 11.4 cases per lakh of female population in 2005 declined to 7.1 by 2010. Interesting

however, this has been a sharp increase in rate during 2010 and 2015. During this period, rate of such crimes increased by about five times. Spatially spreading, crime hot spots, which were scatted toward peripheral areas, having rural and slum population, entered in all parts of Chandigarh by 2015.

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CHANDIGARH  
Hot-Spot of Kidnapping and Abduction of Women, 2005-2015



Source: Police Headquatar, Chandigarh

The Lack of child and parent's communication inside and outside the home, Low level of living, lack of basic amenities availability, and lack of house ownership of houses in these areas are major cause behind this scenario.

Table: Chandigarh: Changing Geography of Kidnapping and Abduction of Women Hot Spots during 2005-2015

Year	Hot Spot Area Name
2005	Ward no 17, Maloya, Dadu Majra, Palsora, Mani Majra, Maloya, Hallo Majra, Muli Jagran <b>Total=4</b>
2010	Maloya, Palsora, ward no. 14, 15, 17 & 18 <b>Total=6</b>
2015	Dhanas, Muli Jagran, Kaimbwala, Mani Majra and Khuda Ali Sher, Sarangpur, Mani Majra, Raipur Kalan & khurd ward no. 3,12,14,15, 19, 20, 21, 23 and 25 <b>Total=20</b>

Source: Based on data/information collected through fieldwork conducted during November and December, 2016

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# Legality of Ill-Treatment of Stray Dogs: A Study

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**Abstract-** The authors in this paper discuss about the growing populations of the stray dogs and how the increase of the population of these stray dogs pose a danger to the humans and how these dogs are violating the rights of the Human beings. The Municipal authorities and other authorities responsible for sterilization of stray dogs are not working efficiently to control their population and no steps are being taken to control them. The problem has aggravated to such an extent that judiciary had to intervene but no unanimous decision has been provided as such and they problem still persists. In such situations people tend to take laws into hands and started killing the dogs as it happened in Kerala.

The methodologies used by the authors are Doctrinal.

The authors have also suggested some particular ways in which the growth of the stray dogs can be checked and their population to be controlled effectively so that these stray dogs do not become threat to the society as is the present scenario. The suggestions include the sterilization of stray dogs efficiently not just on papers but by prompt actions by the Municipalities combined with non littering of food on road side. With these steps taken authors believe that stray dogs can be controlled without going into extremities.

## I. INTRODUCTION

It is said that “dogs are best friends of human beings” true but in many parts of our country it may not be called so. As the number of stray dogs have increased rapidly in our country due to easy availability to the domestic waste thrown at different places across the city. The number of stray dogs on road is posing a huge problem in the life of normal people. The most important fundamental rights of the individuals i.e. Right to Life (Article 21) are now being curtailed by the stray dogs across the countries. However harsh it may sound, but the person who is attacked by a group of stray dogs at the middle of night would not disagree with my perceptions.

Judicial activism in our country has developed many folds and Supreme Court has gone further and has established that right to clean environment and right to have a peaceful sleep at night as the basic fundamental rights under Article 21 of the constitution but growing menace of the dogs have been violating the basic human rights as a person who is returning from office at night is more worried about how he would walk to his house as the stray dogs will give him a hard time, even he reaches home safely which is probably quite difficult keeping in view the birth rate of the dogs, he will not having a sound sleep at night because the howling and fighting of the dogs will carry out whole night. So the stray dogs are the creatures which are violating the fundamental rights of the humans in our country.

At this point where the fundamental rights of the individuals are violated the animal rights of the dogs shall not be violated as per Indian law street dogs and by the recent judgment of High court of Delhi with respect to street dogs what you cannot do with them is are as follows beating and driving away street dogs, is not allowed. The person who stops another person from feeding a dog shall be put behind bar. So the Animal rights are now placed at a higher footing than the fundamental rights of the individuals as dogs as the dogs can neither be dislocated from their location or kept in protective custody but only action which can be taken against the dogs is to sterilize and vaccinate the dogs and then put the dog back in the same location from which the dog was taken from.<sup>1</sup>

With reference to clause of nuisance as defined under torts and IPC

### Section 268 in The Indian Penal Code

**268. Public nuisance.—A person is guilty of a public nuisance who does any act or is guilty of an illegal omission which causes any common injury, danger or annoyance to the public or to the people in general who dwell or occupy property in the vicinity, or which must necessarily cause injury, obstruction, danger or annoyance to persons who may have occasion to use any public right. A common nuisance is not excused on the ground that it causes some convenience or advantage.**

The definition here talks about a person making nuisance causing common injury danger or annoyance but the same is caused by some other creature what recourse do we have? we cannot call authorities to help in this situation or call the municipalities and tell about them that we have been given the powers just to sterilize and vaccinate but if they indulge into howling and fighting at the dead of the night we do not have any other option but to tolerate this form of nuisance day after day because dogs cannot be prosecuted under the Indian Penal Code for causing Nuisance but humans can be prosecuted for cruelty to animals under IPC and also violations for Animal rights. So basically the human beings have no other option but to bear with the daily nuisance created by the dogs and any approach to the concerned authorities would not yield much of a result.

This is not end of the menace of dog. The other threat and danger that our society are facing in day to day life are like road accidents caused by these stray dogs often wonder on to the roads, putting pedestrians, cyclist at risk of serious injury or even to deaths, and these dogs are not properly maintained, so they may have organism in their faces that can cause even blindness

<sup>1</sup><http://jaagruti.org/2013/07/09/pet-dogs-and-street-dogs-dos-and-donts>

to the people.<sup>2</sup> There are numerous cases regarding the child death caused by stray dogs, but some of the very worst cases which had happened in our India's capital city New Delhi and which is full filled with all the amenities to control the menace of Dogs , but they were failed to do their part of duties in order to protect the life of the human beings and these stray dogs showed us that how dangerous they are when they are in furious state of mind . So one of the incident which happened in Delhi was a pack of stray dogs bit a seven-year-old boy to death after he accidentally fell on one of them while playing at a graveyard near his house <sup>3</sup>and the another case was a six-year-old boy was mauled to death by four stray dogs when he was playing in the garden and out of sudden these stray dogs attacked on him.<sup>4</sup>According to the municipal health departmentthe number of cases of dog bites was 53,051 in 2001, which dropped to 45,183 in 2006. However, the number rose to 54,661 in 2007 and in 2012 the figure went to 82,247. It was said that the number of cases could rise further, as many people take anti-rabies vaccination after a dog bite at private hospitals.<sup>5</sup>

After all this heinous cases which had occurred in New Delhi or in any part of our country .What remedy do we have in our country against this menace of dogs .You will be totally stunned that actually we don't have any strict laws against them. So it is just like a dictatorship that whatever they want they can do with us, but we cannot do anything to them. The only thing we can do to them under the purview of are laws is that If the Municipal corporation thinks it to control street dogs populations. It cannot resort to killing or dislocating. It can be only sterilize and immunize the dogs, and then leave them at the locations that they had been picked from.Please also note, the Municipality Corporation cannot just pick up dogs, simply because some persons/ administrators don't like their being around. Even the dogs that are complained about can only be sterilized and immunized and then left back at the location that they had been picked up from.“A bite by a rabid dog can be fatal if the person does not vaccinated. At present, there is no treatment for rabies. Despite the availability of a vaccine, India reports 20,000 deaths every year.” said RanjitMankeshwar, in-charge, anti-rabies vaccination clinic at the JJ Hospital, who gets 200 patients of dog bites every month.

The prime reason for the high rates of stray dogs in our country is the easy availability of the food which is particularly because of the littering of waste food on the road and no efficient way of disposal of waste which becomes the staple food for the stray dogs unlike in developed countries wherein the stray dogs cannot survive more than few days, the next factor being the high reproduction rate of the dogs. The authorities have come to conclusion keeping in mind the animal lovers and the laws in force in India, the only precautions that can be taken against the

dog is to sterilize the creature and vaccinate him and leave him in the same place where he was uplifted but what they fail to understand is that even if the dog is sterilize the canine teeth it posses it is capable to tearing apart the flesh of human beings and in various cases it is the cause of deaths of the infants and causing grievous hurt to other individuals. A scientific study has revealed that dogs tend to become more ferocious when sterilized and thereby causing more harm to the people.

***As per the Indian law , street dogs cannot be beaten , killed or driven away or displaced or dislocate, they can only be sterilized in the manner envisaged in the Animal Act 1960, vaccinated and then returned back to their original locations.***

The Animal Birth Control Rules (ABC rules) formulated under Prevention of Cruelty to Animals Act of 1960 mandated killing of only rabies-afflicted, incurably-ill or mortally-wounded dogs. Regarding 'trouble-causing' dogs, the Act says, on receipt of a complaint, the animal welfare board shall take away a dog and sterilise it. In spite of many incidents of stray dogs biting school children and pedestrians, the Corporation did not take any action on the basis of above mentioned rules. The non-availability of free anti-rabies injection in General Hospital which forces the victim to buy the medicine from private medical shops and hospitals is also a serious issue and the corporations do not take responsibility to bring about any reforms to the present situations. The rules specify that only "incurably ill and mortally wounded dogs as diagnosed by a qualified veterinarian" be euthanized. Dogs suspected of having rabies must be captured and isolated. If rabies is confirmed, they must be allowed to die natural death in isolation.

The situation has worsened with time and judiciary has approached to intervene in the present matter.In various cases our honorable supreme court has rejected the plea regarding the killing of dogs and has held that it is inhuman to kill the dogs mercilessly but also has failed to provide any mechanism to stop the menace of these stray dogs. These canine animals are not threat of any injury but are also make people susceptible to the diseases such as rabbies if the person has not been vaccinated. Due to increase in the number of stray dogs numerous petitions have been filed in across different High Courts our country but has not served the requisite purpose so people agitated by no action taken have taken prompt action to kill the dogs to stop the menace as it happened in Kerala few days back. The judiciary has also failed to tackle the present situation as the judiciary is divided on few platforms as Kerala High court has passed the order to kill the stray dogs which has been stayed by the Supreme court and Bombay High Court also gave permission to kill the stray dogs in 2009 but the judgment was again challenged later in that year and stay order was provided by the Hon'ble Supreme Court.

## II. CONCLUSION& SUGGESTIONS

Now the growing menace of dogs have raised a vital question as to whose right has superintendence over the right of the other, now the question is shall we protect our Human rights or shall we protect the animals for whom our own Human rights are being end endangered. There are people who are directly affected by the stray dogs in form of dog bites and howling at night, there are as many as 500 dog bites reported in Delhi and

<sup>2</sup> <http://www.who.int/bulletin/volumes/87/12/09-021209/en>

<sup>3</sup> <http://timesofindia.indiatimes.com/city/delhi/Stray-dogs-bite-7-year-old-Delhi-boy-to-death/articleshow/48353184.cms>

<sup>4</sup> <http://indianexpress.com/article/cities/delhi/stray-dogs-maul-6-year-old-boy-to-death-in-jamia-nagar>

<sup>5</sup> <http://www.hindustantimes.com/mumbai/82-247-cases-of-dog-bites-reported-in-2012/article1-1037687.aspx>

thus we can imagine the noise by howling of these dogs at night<sup>6</sup>. The decision of the courts are also diversified in this particular matter and Supreme Court has also not provided any substantial judgment on this regard as the legislatures and other Municipal Authorities are not able to cope with this particular situation with the number of complaints increasing day by day and the laws in force i.e. dogs can only be sterilized and to be returned to that particular are not competent enough to deal with the situation as population of canine animals have increased many fold and effective measures are to be implemented to combat with the growing menace of dogs.

Taking into consideration the increasing menace of stray dogs in the city and other areas, various ideas came up to prepare an action plan to curb the growing menace. Sterilisation is an effective way to control the population of stray dogs but this procedure can only be effective, if only the municipality and other agencies do their work efficiently. Though this can only control the breeding of dogs. Nextly the stray dogs who are ferocious can be taken by the municipality and other agency to an incubated place where they are sterilised and kept in captivity within some acres of land where they can have a restricted jurisdiction and also people would be safe of their menaces., the last and foremost way to deal with the stray dogs is to dispose off the domestic waste effectively as done by developed countries and also *Swachh Bharat* campaign initiated by our Prime minister, which is an effective way to deal with the problems of stray dogs as they mostly feed on the food littered in the streets and in the event of non-littering and municipal authorities doing their work efficiently of sterilisation of dogs can be an effective way to bring down the population of dogs and effectively deal with problems of stray dogs.

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<sup>6</sup><http://www.thehindu.com/news/cities/chennai/deaths-due-to-rabies-high-in-india/article7717560.ece>



# Synthesis, Characterisation and biological activity of some Heterocyclic Derivatives

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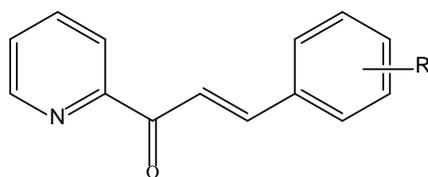
**Abstract:** In this study the chemistry of Heterocyclic Chalcones has generated intensive scientific interest due to their biological and industrial applications. Chalcones are natural biocides and are well known intermediates in the synthesis of heterocyclic compounds exhibiting various biological activities. A new series of Heterocyclic chalcones showed diversified biological activities. According to Claisen-Schmidt condensation a series of novel substituted thiophenyl chalcones were synthesized and evaluated for their antibacterial and antifungal activity against three different bacterial strains such as *Moraxella*, *Enterobacter* and *Pseudomonas aeruginosa* and three fungal strains against *Candida albicans*, *A.niger* and *Trichophyton*. The synthesized compounds have been characterized by TLC, elemental analysis, IR and <sup>1</sup>H & <sup>13</sup>C NMR spectroscopy.

**Key words:** Claisen-Schmidt condensation, Chalcone, antibacterial & antifungal activity

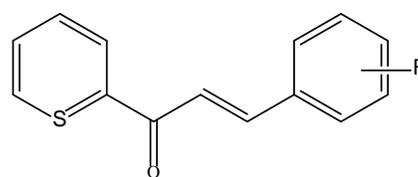
## Introduction

The chemistry and biological activities of Heterocyclic chalcone<sup>(1)</sup> have been of interest for a long time. Chalcones are intermediary compounds of the biosynthetic pathway of the naturally flavonoids.

Structure of heterocyclic chalcones obtained from the Claisen Schmidt condensation between heteroaryl methyl ketones and substituted benzaldehydes.



pyridine-2-yl-chalcone



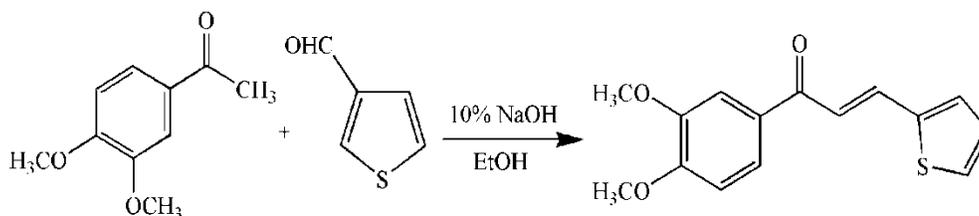
thiophene-2-yl-chalcone

The benefit of synthesis and comparative investigation of biological activity of synthetic chalcone analogues with similar structure is the possibility to study the structure-activity relationship. The compounds with chalcone derivative as backbone have been reported to possess varied biological and pharmacological activities, including antimicrobial<sup>(2-4)</sup>, anti-

inflammatory<sup>(5)</sup>, analgesic<sup>(6)</sup>, cytotoxic<sup>(7)</sup>, antimalarial<sup>(8)</sup>, antitubercular<sup>(9)</sup>, anti-HIV<sup>(10)</sup>, antifeedant<sup>(11)</sup>, anticonvulsant<sup>(12)</sup> and antioxidant<sup>(13)</sup> activities. Thus chalcone continue to attract considerable scientific attention because of their association with a variety of biological activity properties are well documented in the literature.

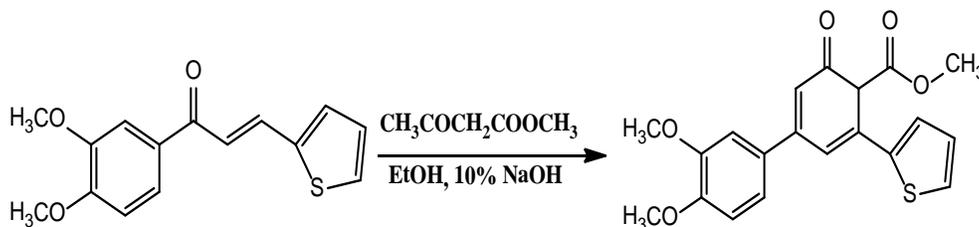
### Synthesis of 1-(3,4-dimethoxyphenyl)-3-thiophen-2-yl-propenone:

Equimolar mixture of 2,3-dimethoxyacetophenone (0.01 mol) and thiophene-2-cabaldehyde (0.01 mol) were dissolved in 20 ml of ethanol in a 250 mL round bottomed flask. The reaction mixture was magnetically stirred for 3h in ice-cold condition, during stirring 10 ml of 10% sodium hydroxide solution was added drop wise. A flocculants precipitate was formed. The precipitate was filtered and washed with cold water. The solid obtained was purified by column chromatography using silica gel 60-120 mesh and n-hexane: acetone (7:3 v/v) as elevate.



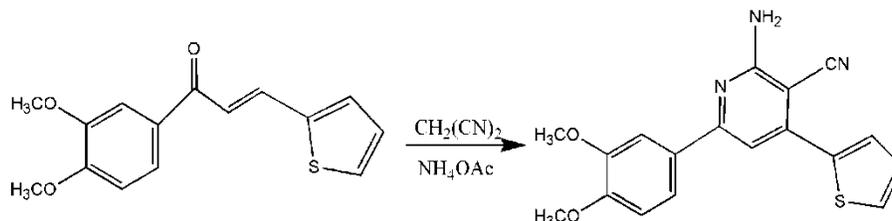
### Synthesis of 4-(3,4-dimethoxyphenyl)-2-oxo-6-thiophen-2-yl-cyclohex-3-ene carboxylic acid methyl ester (III)

A mixture of 1-(3,4-dimethoxyphenyl)-3-thiophen-2-yl-propenone (0.001mol) and methylacetoacetate (0.001 mol) in ethanol was refluxed for 4 h in the presence of 0.8 mL of 10% NaOH. The reaction mixture was cooled and poured into 50 mL of ice-cold water. The precipitate was collected by filtration, washed with water and dried in air giving brown solid. The yield of the product was 78%, melting point 140<sup>0</sup>C.



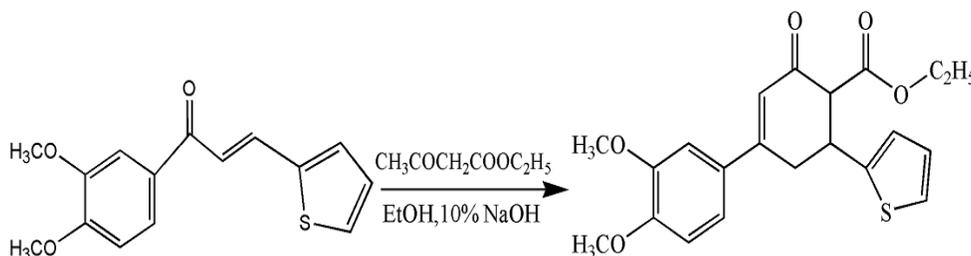
### Synthesis of 2-Amino-6-(3,4-dimethoxyphenyl)-4-thiophen-2-yl-nicotinonitrile (V)

A mixture of 1-(3,4-dimethoxyphenyl)-3-thiophen-2-yl-propenone (0.001 mol) and malononitrile (0.001 mol) and ammonium acetate (0.077g) in ethanol (20 mL) was refluxed 8 h. The reaction mixture was cooled and poured into ice-cold water. The precipitate was collected, filtration and dried in air. The solid obtained was recrystallized in ethanol gave an orange yellow crystal. The yield of the product was 73%, melting point 202<sup>0</sup>C.



### Synthesis of 4-(3,4-dimethoxyphenyl)-2-oxo-6-thiophen-2-yl-cyclohex-3-ene- carboxylic acid ethyl ester (VII)

A mixture of 1-(3,4-dimethoxyphenyl)-3-thiophen-2-yl-propenone (0.001 mol) and ethylacetoacetate (0.001 mol) in ethanol was refluxed for 6 h in 10-15 mL of ethanol in the presence of 10% 10 mL NaOH. The progress of the reaction was monitored by TLC using methanol: chloroform (3:10 v/v) as eluent. The solid obtained was recrystallized in ethanol gave an brown crystal. The yield of the product was 80%, melting point 124<sup>0</sup>C.



### Result and Discussion

**4-(3,4-dimethoxyphenyl)-2-oxo-6-thiophen-2-yl-cyclohex-3-ene carboxylic acid methyl ester: IR spectra:** C<sub>6</sub>H<sub>5</sub>: 3080.20, -CH<sub>3</sub>: 2832.76, C=N: 1597.04, C-C: 1120.97, C-O-C: 1268.46, Ring C-C: 1514.05 and C<sub>4</sub>H<sub>4</sub>S: 859.78. <sup>1</sup>HNMR: C<sub>4</sub>H<sub>4</sub>S: 6.99-7.01(m), -C<sub>6</sub>H<sub>5</sub>: 6.86 (m), CH=CH: 6.83 (m), 3-CH<sub>3</sub>: 3.89 (m), -CH: 3.88 (m) and -C=C: 2.26 (d). <sup>13</sup>CNMR: C<sub>6</sub>H<sub>5</sub>S: 122.82-128.22, 140.45, -C<sub>6</sub>H<sub>5</sub>: 110.59-120.32, 149.14, C=O: 171.94, -COO: 197.32, 3-CH<sub>3</sub>: 55.98 and CH=CH: 153.16.

### 2-Amino-6-(3,4-dimethoxyphenyl)-4-thiophene-2-yl-nicotinonitrile:

**IR spectra:** -NH<sub>2</sub>: 3109.06, C<sub>6</sub>H<sub>5</sub>: 3079.76, -CH<sub>3</sub>: 2906.18, C≡N: 2285.62, C=N: 1596.45, C-N: 1024.91, C-C: 1121.22, C-O-C: 1205.31 and C<sub>4</sub>H<sub>4</sub>S: 810.22. <sup>1</sup>HNMR: C<sub>4</sub>H<sub>4</sub>S: 7.07-7.22 (m), -

$C_6H_5$ : 6.88-7.40 (m),  $C_5H_5N$ : 7.41 (d),  $-NH_2$ : 3.96 (d) and  $-CH_3$ : 3.93 (m).  $^{13}C$ NMR:  $C_4H_4S$ : 122.76-127.27, 140.38,  $-C_6H_5$ : 111.47-120.25, 133.61, 149.07,  $-C-N$ : 164.74,  $C_5H_5N$ : 110.54, 153.18, 154.07,  $-C\equiv N$ : 118.75 and  $-CH_3$ : 55.86.

**4-(3,4-dimethoxyphenyl)-2-oxo-6-thiophen-2-yl-cyclohex-3-ene carboxylic acid methyl ester: IR spectra:**  $C_6H_5$ : 3080.23,  $-CH_3$ : 2928.00,  $-C=O$ : 1647.75,  $-COO-$ : 1269.69,  $C-O-C$ : 1205.21 and  $C_4H_4S$ : 809.86.  $^1H$ NMR:  $C_4H_4S$ : 6.91-7.09 (m),  $-C_6H_5$ : 6.94 (m),  $CH=CH$ : 6.91 (m),  $3-CH_3$ : 3.97 (m),  $-CH$ : 3.96 (m) and  $-C=C$ : 2.27, 4.10 (m).  $^{13}C$ NMR:  $C_6H_5S$ : 122.82-128.37, 140.45,  $-C_6H_5$ : 110.60-120.32, 149.14,  $-C=O$ : 197.32,  $-COO$ : 175.21,  $3-CH_3$ : 55.93, 13.60 and  $CH=CH$ : 153.16.

## BIOLOGICAL EVALUATION

### Antimicrobial activity

The antimicrobial activity of synthesized compounds was carried out using agar well diffusion method. The bacterial strains were collected from different infectious status of patients who had not administered any antibacterial and antifungal drugs for at least 2 weeks with the suggestions of an authorized physician, in Eumic analytical Lab and Research Institute, Tiruchirappalli, Tamilnadu state, India. The *in vitro* antimicrobial activity was carried out against 24 h culture of three bacterial strains *Moraxella*, *Enterobacter* and *Pseudomonas aeruginosa*. Three fungal strains were *Candida albicans*, *A.niger* and *Trichophyton*. The compounds were tested at 25, 50, 75 and 100 $\mu$ g/mL different concentration against both bacterial and fungal strains. DMSO was used as a vehicle. *Erythromycin* and *Ciprofloxacin* were used as standard drugs for comparison of antibacterial and antifungal activities respectively. The zone of inhibition was compared with standard drug after 24 h of incubation at 37 $^{\circ}$ C for antibacterial activity and 8 h at 37 $^{\circ}$ C for antifungal activity.

**Antimicrobial activity of 4-(3,4-dimethoxyphenyl)-2-oxo-6-thiophen-2-yl-cyclohex-3-ene  
carboxylic acid methyl ester (C-III)**

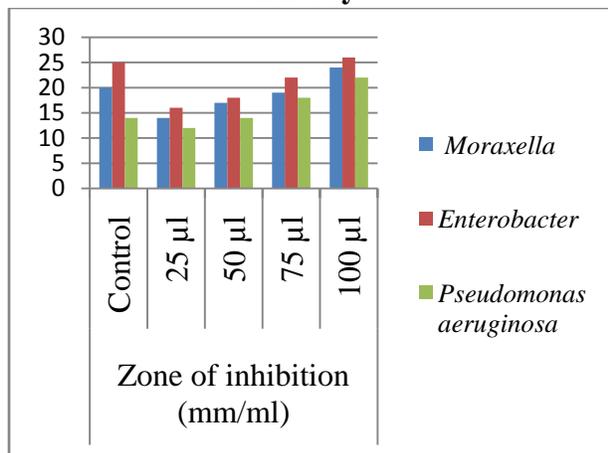
**Antibacterial activity**

Bacterial Strain	Zone of inhibition (mm/ml)				
	Control	25 $\mu$ l	50 $\mu$ l	75 $\mu$ l	100 $\mu$ l
<i>Moraxella</i>	20	14	17	19	24
<i>Enterobacter</i>	25	16	18	22	26
<i>Pseudomonas aeruginosa</i>	14	12	14	18	22

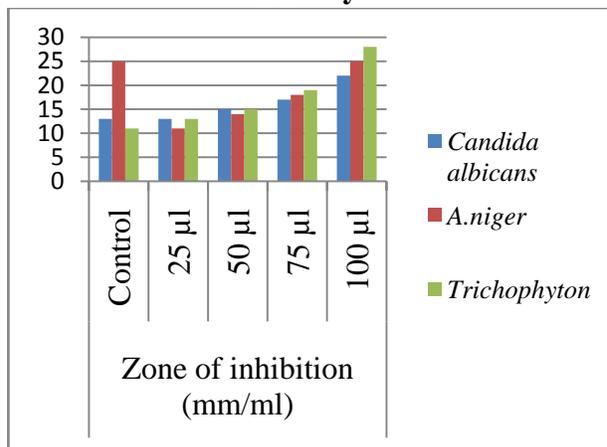
**Antifungal activity**

Fungi strain	Zone of inhibition (mm/ml)				
	Control	25 $\mu$ l	50 $\mu$ l	75 $\mu$ l	100 $\mu$ l
<i>Candida albicans</i>	13	13	15	17	22
<i>A.niger</i>	25	11	14	18	25
<i>Trichophyton</i>	11	13	15	19	28

**Graphical representation of antibacterial activity**



**Graphical representation of antifungal activity**



## Antimicrobial activity of 2-Amino-6-(3,4-dimethoxyphenyl)-4-thiophen-2-yl-nicotinonitrile (V)

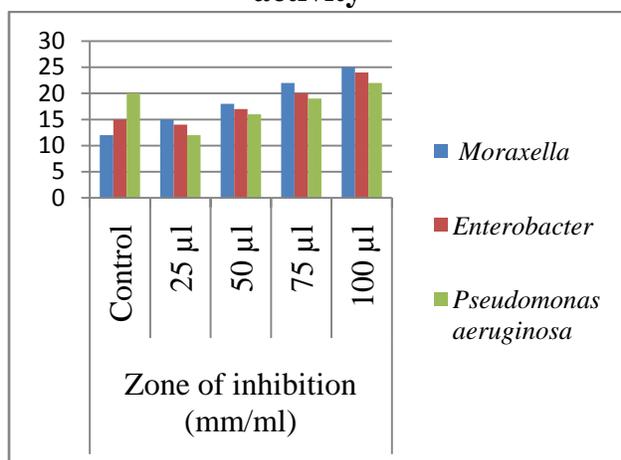
### Antibacterial activity

Bacterial Strain	Zone of inhibition (mm/ml)				
	Control	25 $\mu$ l	50 $\mu$ l	75 $\mu$ l	100 $\mu$ l
<i>Moraxella</i>	12	15	18	22	25
<i>Enterobacter</i>	15	14	17	20	24
<i>Pseudomonas aeruginosa</i>	20	12	16	19	22

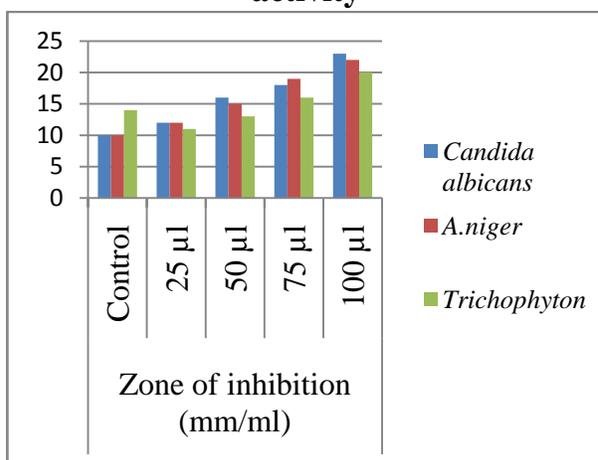
### Antifungal activity

Fungi strain	Zone of inhibition (mm/ml)				
	Control	25 $\mu$ l	50 $\mu$ l	75 $\mu$ l	100 $\mu$ l
<i>Candida albicans</i>	10	12	16	18	23
<i>A.niger</i>	10	12	15	19	22
<i>Trichophyton</i>	14	11	13	16	20

### Graphical representation of antibacterial activity



### Graphical representation of antifungal activity



## Antimicrobial activity of 4-(3,4-dimethoxyphenyl)-2-oxo-6-thiophen-2-yl-cyclohex-3-ene- carboxylic acid ethyl ester (VII)

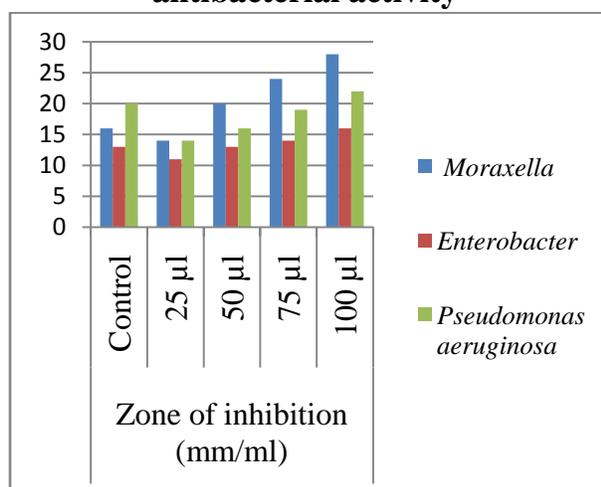
### Antibacterial activity

Bacterial Strain	Zone of inhibition (mm/ml)				
	Control	25 $\mu$ l	50 $\mu$ l	75 $\mu$ l	100 $\mu$ l
<i>Moraxella</i>	16	14	20	24	28
<i>Enterobacter</i>	13	11	13	14	16
<i>Pseudomonas aeruginosa</i>	20	14	16	19	22

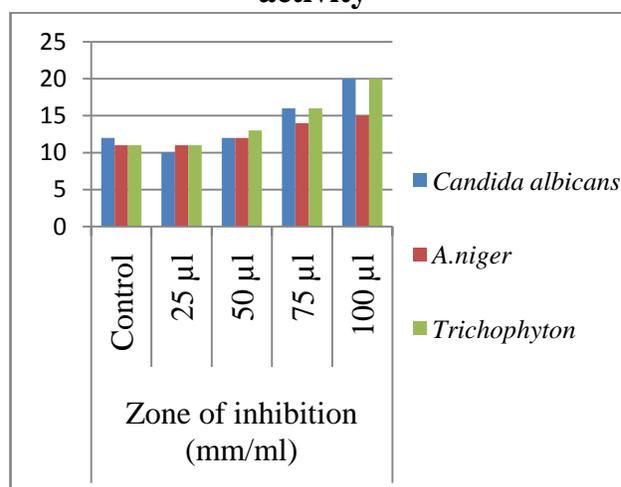
### Antifungal activity

Fungi strain	Zone of inhibition (mm/ml)				
	Control	25 $\mu$ l	50 $\mu$ l	75 $\mu$ l	100 $\mu$ l
<i>Candida albicans</i>	12	10	12	16	20
<i>A.niger</i>	11	11	12	14	15
<i>Trichophyton</i>	11	11	13	16	20

### Graphical representation of antibacterial activity



### Graphical representation of antifungal activity



## CONCLUSION

A series of Chalcone derivatives were successfully synthesized and characterized spectroscopically by IR,  $^1\text{H}$  and  $^{13}\text{C}$ -NMR. All the synthesized products were screened for their *in - vitro* antibacterial and antifungal properties. The experimental results revealed that all compounds displayed moderate to good antibacterial and antifungal activity with reference to the standard against the tested organisms.

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# Approach to Maximize the Better Throughput for CSMA and TDMA Protocols

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**Abstract**— A process on the local host, called a client, needs services from a process usually on the remote host, called a server. A transport layer protocol can either be connectionless or connection-oriented. In a connectionless service, the packets are sent from one party to another with no need for connection establishment or connection release. The packets are not numbered; they may be delayed or lost or may arrive out of sequence. In a connection-oriented service, a connection is first established between the sender and the receiver. Data are transferred. At the end, the connection is released. TCP and SCTP are connection-oriented protocols while There is no acknowledgment in UDP, which is connectionless. TCP uses flow and error control mechanisms at the transport level. The main focus of congestion control and quality of service is data traffic. In congestion control we try to avoid traffic congestion. In quality of service, we try to create an appropriate environment for the traffic. IEEE 802.11 is based on CSMA with Collision Avoidance (CSMA/CA) protocol, which can be seen as a combination of the CSMA and MACA (Multiple Access Collisions Avoidance) schemes. The term Contention Period is used in wireless networks supporting the IEEE 802.11 standards. It defines a period of time during which nodes attempts to catch Wireless Medium for data transmission and for MAC-TDMA it is termed as time bound packet transmission. 802.11 MAC is having problems such as large delay, hidden terminal problems and complexity to routing. This paper appraise the problem presents solution to the problem through new version of TCP and Mac TDMA by doing time bound packet transmission in slots. Contention implementation in different node nos. and slot sizes is a concoction of CSMA and TDMA in order to have better throughput, lesser delay and energy efficient usage.

**Index Terms**- CSMA, TDMA, CSMA/CD, CSMA/CA, MAC, MAC-TDMA & Slot time

## I. INTRODUCTION

IEEE 802.11-2007, Revision of IEEE Std 802.11-1999 was approved on 08.03.2007 and published on 12 June 2007 by IEEE. This revision gives the IEEE 802.11 standard for wireless local area networks (WLANS) with all the amendments that have been published to date i.e.08.03.2007. The original standard was published in 1999 and reaffirmed in 2003. The 802.11 standard includes a basic Distributed Coordination Function (DCF)[1]. The DCF is the fundamental access method used to support asynchronous data transfer on the best effort basis. As specified in standards, the DCF must be supported by all the stations in a basic service set (BSS). The DCF is based on CSMA/CA.

There are two techniques used for packet transmitting in DCF. The default one is a two-way handshaking mechanism, also called basic access method. The destination station transmits a positive acknowledgement (ACK) message to signal a

successful packet transmission. The other optional mechanism is a four-way handshaking access method, which uses the request-to-send/clear-to-send (RTS/CTS) technique to reserve the channel before data transmission.

MAC protocol should be capable enough to tackle these kinds of issues.

**Synchronization:** The design of MAC should take into account the requirements of time synchronization. Synchronization involves use of sources like bandwidth, power consumption efficiently. The control packets used for synchronization can result in collisions also.

**Throughput:** The MAC protocol designed for wireless network should work to enhance the throughput of the system. By minimizing the occurrence of collisions, control overhead and maximizing the channel utilization can help in increasing the throughput of the system.

**Access Delay:** The access delay is the average delay that any packet experiences during its transmission. The design of MAC protocol should be capable enough to minimize these delays.

**Energy Management:** The energy is a major concern and probably the biggest challenge. Energy management is the process of managing the sources and consumers of energy in a node or in the network. It is a big challenge to shape energy discharging pattern of a node's battery to enhance the battery life so as to find the routes using minimum energy.

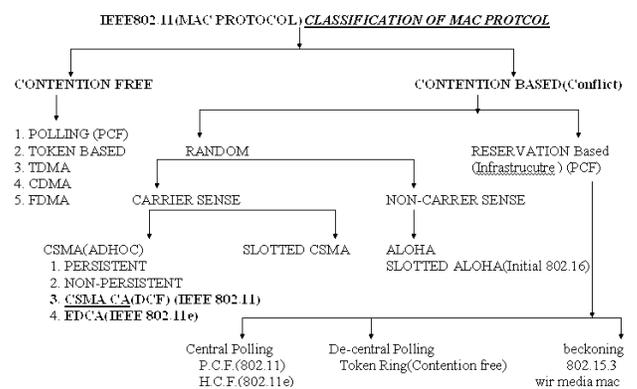


Fig 1 : CSMA/CA (IEEE 802.11) Protocol

The 802.11 legacy MAC does not support the concept of differentiating frames with different priorities. Basically, the

DCF is supposed to provide a channel access with equal probabilities to all stations contending for the channel access in a distributed manner. However, equal access probabilities are not desirable among stations with different priority frames[49]. Thus the several drawbacks of DCF are as follows:

- DCF can only support best effort services, not any QoS guarantees.
- In DCF, all the stations in one Basic Service Set (BSS) or all the flows in one station compete for the resources and channel with the same priorities.
- There is no differentiation mechanism to guarantee bandwidth, packet delay and jitter for high priority stations or multimedia flows.
- Throughput degradation and high delay are caused by the increasing time used for channel access contention.

The emerging EDCF is designed to provide differentiated, distributed channel accesses for frames with 8 different priorities (from 0 to 7) by enhancing the DCF for real time traffic such as video, voice and Data.

**Congestion** in a network may occur if the load on the network i.e.the number of packets sent to the network is greater than the capacity of the network—the number of packets a network can handle.

Congestion in a network or internetwork occurs because routers and switches have queues-buffers that hold the packets before and after processing.

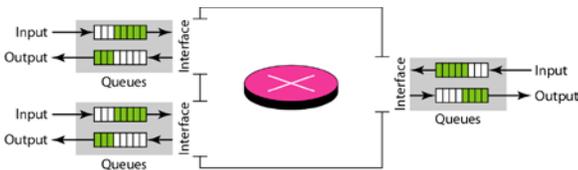


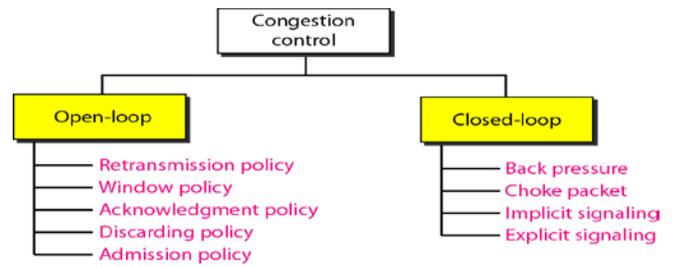
Fig 2: Queue Management

Congestion Control mechanisms and techniques are used to control the congestion and keep the load below the capacity.

II. BACKGROUND

Many Papers have been published relating to performance of wireless Lan based on Mac Protocol In which probability distribution of the MAC layer packet service time (i.e., the time interval between the time instant a packet starts for transmission and the time instant that the packet either is acknowledged for correct reception by the intended receiver or is dropped) has been characterized. Different types of traffic such as video, voice and data has been taken into account that means performance evaluation DCF vs. EDCF has been done. Papers are being there relating to better throughput with less delay for MAC and TDMA but blending it for different node nos. and slot sizes is a need of time in order to have better throughput, lesser delay and energy efficient usage.

In general, we can divide congestion control mechanisms into two broad categories: **open-loop congestion control (prevention) and closed-loop congestion control (removal).**



**Network Performance ;** Congestion control involves two factors that measure the performance of a network: **delay and throughput.**

**Delay:** The minimum delay is composed of **propagation delay and processing delay.** We also need to add the waiting time in the queues (for all routers in the path) to the total delay. When a packet is delayed, the source, not receiving the acknowledgment, retransmits the packet, which makes the delay, and the **congestion, worse.**

**Throughput :** We can define throughput in a network as the **number of packets passing through the network in a unit of time.** When the load exceeds the capacity, the queues become full and the routers have to discard some packets, it results in throughput declines sharply.

**Backpressure** refers to a congestion control mechanism in which a congested node stops receiving data from the immediate upstream node or nodes. This may cause the upstream node or nodes to become congested, and they, in turn, reject data from their upstream nodes or nodes

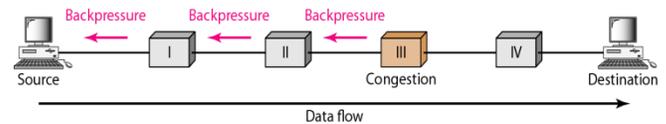


Fig 3: Back Pressure

**A choke packet** is a packet sent by a node to the source to inform it of congestion. In backpressure, the warning is from one node to its upstream node, and last reach the source station. In the choke packet method, the warning is from the router, which has encountered congestion, to the source station directly **using a source quench ICMP message.** The intermediate nodes through which the packet has traveled are not warned.

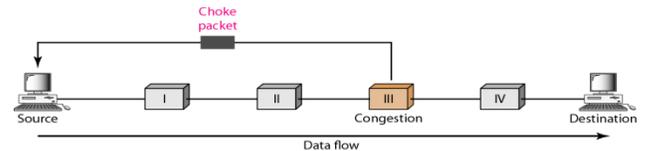


Fig 4: Packet Choking

**Implicit (Unspoken) Signaling :** The source guesses that there is a congestion somewhere in the network from other symptoms. For example, when a source sends several packets and there is no acknowledgment for a while, one assumption is that the network is congested. **Explicit (Clearly).Signaling :** The node that experiences congestion can explicitly send a signal to the source or destination. The explicit signaling method, however, is

different from the choke packet method. In the choke packet method, a separate packet is used for this purpose; in the explicit signaling method, the signal is included in the packets that carry data. Backward Signaling A bit can be set in a packet moving in the direction opposite to the congestion. This bit can warn the source that there is congestion and that it needs to slow down to avoid the discarding of packets. Forward Signaling A bit can be set in a packet moving in the direction of the congestion. This bit can warn the destination that there is congestion.

### III. TOOLS & METHOD

Network Simulator - NS2 is used to simulate the model in order to know the way of increasing the throughput and reduce the delay time where different nodes at different slot time is tested. The general process of creating a simulation can be divided into several parts:

1. Topology definition: to ease the creation of basic facilities and define their interrelationships, ns has a system of containers and helpers that facilitates this process.

2. Model development: models are added to simulation in order to get results and analysis in the form of animation and graph thereof.

3. Node and link configuration: models set their default values, it is customized according to the need of the user as well as model. The statistics appears in trace file format.

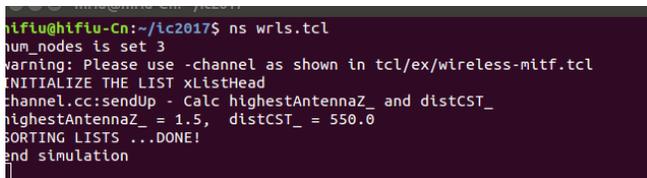


Fig 5: Simulation Through NS2

The Different Trace results formats used in NS2 are as follows :

Table 1: Old legacy Trace-file

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Event	Time	From Node	To Node	Pkt Type	Pkt Size	Flags	Flg Id	Src Addr	Dst Addr	Seq. No.	Pkt id
+	0.2	0	1	Tcp	40	-	1	0.0	1.0	0	0
-	0.2	0	1	Tcp	40	-	1	0.0	1.0	0	0
r	0.210032	0	1	Tcp	40	-	1	0.0	1.0	0	0
+	0.210032	1	0	Ack	40	-	1	1.0	0.0	0	1
-	0.210032	1	0	Ack	40	-	1	1.0	0.0	0	1
r	0.220064	1	0	Ack	40	-	1	1.0	0.0	0	1
+	0.220064	0	1	Tcp	1040	-	1	0.0	1.0	1	2
-	0.220064	0	1	Tcp	1040	-	1	0.0	1.0	1	2
+	0.220064	0	1	Tcp	1040	-	1	0.0	1.0	2	3
-	0.220896	0	1	Tcp	1040	-	1	0.0	1.0	2	3
r	0.230896	0	1	Tcp	1040	-	1	0.0	1.0	1	2

NS2 provides two types of trace format for wireless Network, old wireless trace format and new trace file format. One can use any of the layouts as per his/her requirement and parameters used in simulation.

Table 2: Old Wireless Trace-Format

1	s	R	send, receive, drop, forwarding - s / r / D / f
2	0.2	0.2	timestamp
3	_0_	_0_	node ID for this node
4	AGT	RTR	name of object type tracing or trace level (AGent Trace, Router Trace, MAC, and so on)
5	---	---	reason for tracing
6	1	1	packet identifier
7	tcp	Tcp	packet type
8	40	40	packet size
9	{13a 1 0 800}	{13a 1 0 800}	<b>13a</b> : expected time to send data in hexa <b>1</b> : MAC destination address <b>0</b> : MAC source address <b>800</b> : type - ARP (0x806) / IP (0x800)
1	-----	-----	
1	{0:0 1:0 32 1}	{0:0 1:0 32 1}	<b>0</b> : source IP address <b>0</b> : source port number <b>1</b> : destination IP address in decimal (8.8.8 format - 36 implies 0.1.0) <b>0</b> : destination port number <b>32</b> : TTL <b>1</b> : next hop address
1	{00}	{00}	TCP sequence number 0 TCP ack number 0
1	0	0	?
1	0	0	?

Table 3: New wireless Trace Format

```
s -t 2.556838879 -Hs 1 -Hd -2 -Ni 1 -Nx 426.02 -Ny 9.49 -Nz 0.00 -Ne
-1.000000 -Nl AGT -Nw --- -Ma 0 -Md 0 -Ms 0 -Mt 0 -Is 1.0 -Id 2.0 -
It cbr -Il 512 -If 0 -Ii 0 -Iv 32 -Pn cbr -Pi 0 -Pf 0 -Po 2
SFESTs 2.709814214 _1_ 0 [1 -> 2] 1(1) to 98 [1 |98 2 ]
r -t 2.731668849 -Hs 2 -Hd 2 -Ni 2 -Nx 40.50 -Ny 47.72 -Nz 0.00 -Ne
-1.000000 -Nl AGT -Nw --- -Ma 13a -Md 2 -Ms 62 -Mt 800 -Is 1.0 -Id
2.0 -It cbr -Il 512 -If 0 -Ii 0 -Iv 31 -Pn cbr -Pi 0 -Pf 2 -Po 2
d -t 2.866032021 -Hs 80 -Hd 1 -Ni 80 -Nx 242.86 -Ny 37.23 -Nz 0.00 -
Ne -1.000000 -Nl IFQ -Nw ARP -Ma 13a -Md 50 -Ms 50 -Mt 800 -Is 2.255
-Id 1.255 -It DSR -Il 60 -If 0 -Ii 20 -Iv 252 -P dsr -Ph 4 -Pq 0 -Ps
2 -Pp 1 -Pn 2 -Pl 4 -Pe 1->2 -Pw 0 -Pm 0 -Pc 0 -Pb 0->0
```

CSMA/CA - A station willing to transmit senses the medium, if the medium is busy then it defers. If the medium is free for a specified time (called DIFS, Distributed Inter Frame Space, in the standard) then the station is allowed to transmit, the receiving station will check the CRC of the received packet and send an acknowledgment packet (ACK). Receipt of the acknowledgment will indicate the transmitter that no collision occurred. If the sender does not receive the acknowledgment then it will retransmit the fragment until it gets acknowledged or thrown away after a given number of retransmissions.

Setting the slot time to an optimum value is important. If slot time is having less value it would result in collision and if it is big value it would result in unnecessary delay and have to wait for an unnecessarily long period of time.

Timing Relation:

-- SIFSTime and SlotTime are fixed per PHY.

$$SIFS = R_xRFDelay + R_xPLCPDelay + MACProcessingDelay + R_xTxTurnaroundTime.$$

$$Slot\ Time\ is = CCATime + R_xTxTurnaroundTime + AirPropagationTime + MACProcessingDelay.$$

-- The PIFS and DIFS are derived by the following equations

$$PIFS = SIFS \text{ Time} + \text{Slot Time}$$

$$DIFS = SIFS \text{ Time} + 2 * \text{Slot Time}$$

TCP Tahoe - This is the original version of TCP congestion control as implemented by Jacobson. Congestion detection mechanism is based on packet loss. Techniques used for congestion control: Slow Start, Congestion Avoidance, Fast Retransmit,

TCP Reno, This is the most popular version of TCP congestion control mechanism today. Techniques used for congestion control: same as TCP Tahoe (Slow Start, Congestion Avoidance and Fast Retransmit), plus Fast Recovery.



Fig 6: Fast Recovery Mechanism

#### IV. RESULTS AND DISCUSSIONS

### Contention implementation

The MAC protocol starts by listening on the channel, and if it is found to be idle, it sends the first packet in the transmit queue. If it is busy, as other node transmission or interference, the node waits the end of the current transmission and then starts the contention (wait a random amount of time).

802.11 Mac is having problems such as large delay, hidden terminal problems and complexity to routing. MAC TDMA solves these problems and does time bound packet transmission in slots. It provides valuable information for routing and congestion control.

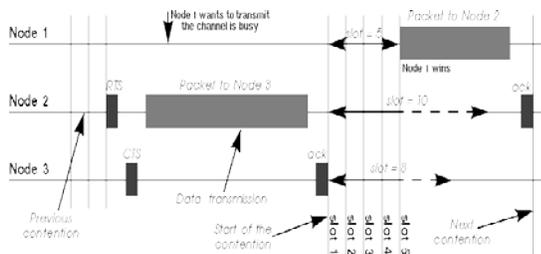


Fig 7 : MAC TDMA

TDMA is not well suited for data networking applications, because it is very strict and inflexible. Mac Tdma is combination of TDMA and Mac. TDMA-based MAC protocols can avoid collisions, overhearing and idle listening and therefore energy efficient. Researches has shown that show that CSMA has better packet delay and throughput performances while static and dynamic TDMA's are more energy efficient.

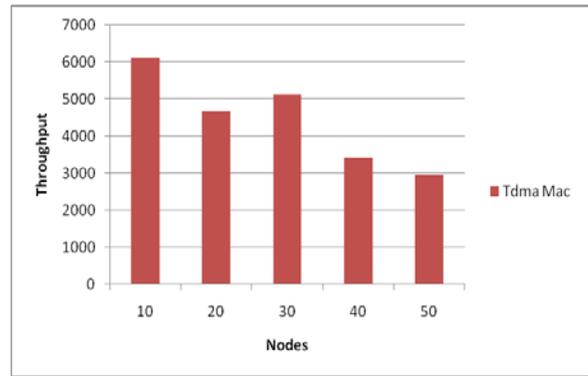


Fig 8 : Throughput at Mac Tdma

In fig 3, throughput is calculated it shows that the maximum average throughput can be achieved by lesser nos. of nodes i.e. lesser nos. of nodes chances of high throughput.

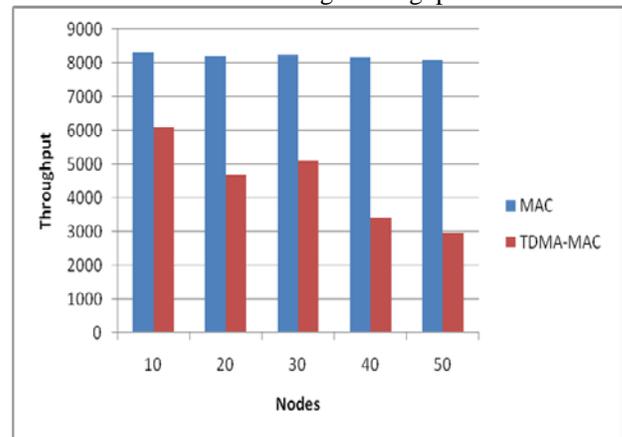


Fig 9 : 802.11 and Tdma Mac

Fig 4 shows the comparison of Tdma Mac with normal mac, it has been found out that normal Mac provides the higher throughput than Tdma mac. It is also found out that throughput is same at all the nodes at normal Mac.

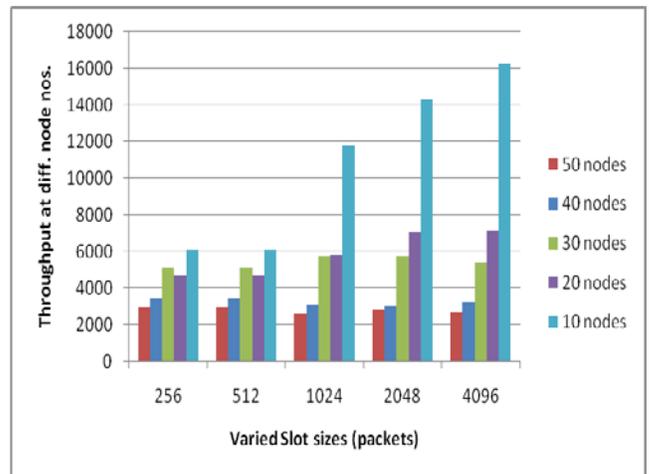


Fig 10 : Contention implementation (Throughput) in different node nos. and slot sizes

Fig 5 implements the contention taking different slot sizes with different nos. of nodes. Small slot sizes as well big one results in approximately the same conclusion that smaller the packets with less nos. of nodes that is 10 or 20 produces more throughput.

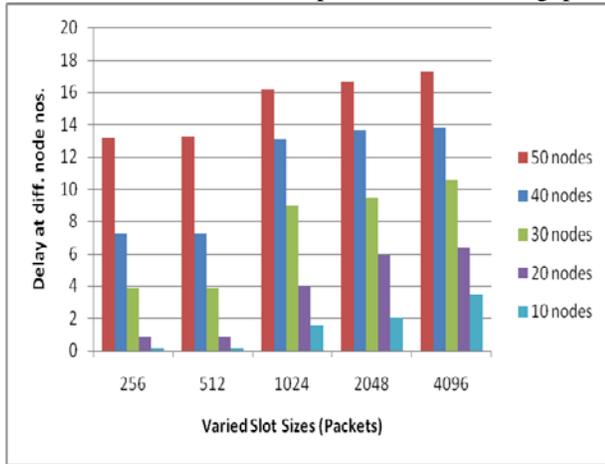


Fig 11 : Contention implementation with delay

Fig 6 implements the contention the same for knowing delay. Small slot sizes as well big one results in approximately the same conclusion that smaller the packets with less nos. of nodes results in least delay. It is very less delay at 10 nodes with 256 slot size.

## V. CONCLUSION AND FUTURE WORK

It has been concluded that the maximum average throughput can be achieved by lesser nos. of nodes and when we compare it Tdma Mac with normal mac, it has been found out that normal Mac provides the higher throughput then Tdma mac. It is also found out that throughput is same at all the nodes at normal Mac. Even when we implement the contention taking different slot sizes with different nos. of nodes. Small slot sizes as well big one results in approximately the same conclusion that smaller the packets with less nos. of nodes that is 10 or 20 produces more throughput and same conclusion for delay that is smaller the packets with less nos. of nodes results in least delay. That means it one achieve least delay at 10 nodes with 256 slot size. One can take this approach for proper planning of Network architecture.

In future, modification in other parameters can be checked for better throughput with fair delay and less packet losses such as maximum and minimum of contention windows etc.

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# TV Content Ratings Systems: A Review of the Literature, Current Trends and Areas of Future Research

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**Abstract**-TV content ratings systems have been put in place by many countries as a way of reducing media effects on children. The relation between media effects and TV content ratings systems has been substantively analyzed within the social scientific community. This article provides such an overview. First, it lays out some of the main theoretical models of media effects, that is, the social cognitive theory and the cultivation theory. Second, it describes existing empirical research. In this section, it demonstrates the origin of content ratings systems and these ratings development over the years, parents understanding of TV content ratings and the factors that influence a parents understanding of these ratings, parental implementation of PG in practice and children's interpretation of their parents' mediation behavior. Third, the article points out future fields of research

**Index Terms**- TV Content Ratings Systems, Media Effects

## 1.0 INTRODUCTION

A substantive amount of scientific research has been carried out on the effects of popular mass media content, especially TV content, on human behavior. Most of these studies have examined the role of television content as an influence on a wide range of behaviors in both children and adult viewers. This is because TV has become so affordable, is easily accessible and is still one of the most loved media. The largest portion of these studies has focused on TV content's negative effect on children's social, cultural, and psychological development (Friedman, 1973; Grier, 2001; Wagner, 2001; Collins et al., 2004) with only a sizeable portion of studies on effects of TV content focusing on the beneficial outcomes for viewers (Kuchment & Gillham, 2008).

Recent studies have revealed that children are spending so much time watching television. Children in Britain, for example, spend an average of 2 hours 40 minutes in front of the television every day (Thomas, 2011). In America, TV is increasingly turning into an electronic babysitter with children spending more time before the screen. According to Nielsen (2010), preschoolers in America, aged 2-5 spend 32.5 hours a week in front of the TV while older pre-teens, aged 6-11, spend 28 hours in front of the TV. Years of research in America and Europe have supported a relationship between children's too much television viewing time and subsequent engagement in violence, teenage sex, and alcohol and drug abuse, among others (Grier, 2001; Collins et al. 2004;

Sargent et al. 2006). This disclosure that the potential of television is enormous and the fact that children are spending more and more time viewing television programs worries many parents.

Studies in America, Canada, UK, India and China have established that parents are very concerned about what their children view on television (Pennsylvania, 2000; Correspondent, 2011; Anlan, 2013). Parents are concerned about children's exposure to too much sexual content, violent content, and alcohol and drug abuse content on TV. Parents are equally concerned about the depiction of alcohol, smoking and drug abuse as "cool" in TV programs. The 2004 Kaiser Foundation National Polls revealed that 60% of American parents are very concerned that their children are getting exposed to too much sexual content on TV, while 49% of the American parents are concerned about the use of adult language in most TV programs. It further revealed that 53% of American parents are concerned that their children are getting exposed to too much violent content on TV. Parents in China are concerned with the amount of violence, crude language in cartoons on Chinese TV. These parents claim that Chinese TV cartoons are sending a bad message (Anlan, 2013).

TV content ratings systems have been put in place by many countries (including Kenya) as a way of reducing media effects on children. The basic mission of these TV content ratings systems is to offer parents some advance information about the content in the program about to be aired so that parents can decide what TV programs they want their children to see or not. This places the responsibility of restricting minor's access to adult TV content primarily on parents. Parents therefore must understand these ratings to enable them carry out this responsibility well. With the exemption of America, there is almost no literature on parents' knowledge of PG-Ratings in other countries. This is fundamental section of the area of media effects that needs to be studied so as to reveal what parents know about PG-Ratings. This knowledge will help establish whether parents use these PG-Ratings to help mitigate media effects on children, or whether there is a need to come up with new methods of preventing children from getting exposed to inappropriate TV programs.

## 1.1 REVIEW OF RELEVANT THEORIES.

Various theories have been used to explain why television content may exert effects in the areas of violence, pre-marital

sex, drugs and alcohol abuse. The social cognitive theory asserts that children learn various behaviors by observing those exhibited by others while the cultivation theory asserts that heavy television viewing leads people to see the world as portrayed on television. These two theories are reviewed below to depict the varied nature of television programs, why this worries parents and why parents should implement parental guidance in practice.

### *1.1.1 The Cultivation Theory*

The cultivation theory developed in 1976 by Professor George Gerbner, dean of the Annenberg School of Communication at the University of Pennsylvania, addresses ways in which Television influences the development of children's knowledge and beliefs about the world. This theory proposes that heavy viewing leads people to see the world as it is portrayed on television. Television programs over-represent the use of coarse language, the occurrence of violence, engagement in sexual activities, and the indulgence in alcohol and alcoholic drinks.

Studies have indicated media effects on teens' beliefs about sexuality (Aubrey et al. 2003; Brown et al. 2006; Buerkel-Rothfuss & Strouse 1993). Collins et al. (2004) found out that among teen virgins, those who frequently viewed TV programs with sexual content were twice as likely to engage in sexual intercourse in the following year as compared to those viewing less sexual programming. Similar results concerning media exposure and sex initiation were reported by Brown et al. (2006). With more studies revealing that the level of sexual content in television programs is on the rise it is important that parents implement parental guidance in regards to television viewership so as to alleviate the effects of sexual content on children. Content studies indicate that about 70% of recent television programs contain some verbal or behavioral sexual content. While 67% of television programs that are popular with teenagers contain frequent talk about sex (Kunkel, Cope, & Biely, 1999). A study carried out by Leone and Osborn (2004) indicated an increase in sexual content on TV from 2000-2003.

Media sexuality appears to influence initiation of sex through shaping of teen viewers' perceptions of sexual norms, sexual patience, lowered expectations of potential negative consequences, and sexual self-efficacy beliefs (Kunkel, Cope, & Biely, 1999; Martino et al. 2005). TV is accused of rarely presenting messages about the risks or responsibilities associated with sexual behavior. The cultivation theory suggests that consistent portrayal of sexual content in the media cultivates common beliefs about sexual norms and patterns of sexual behavior, especially among frequent media users (Brown & Lu: 2006). Facilitation of sexual behavior in children and particularly adolescents by television depictions has obvious implications for

public concerns especially health-wise over unwanted pregnancies and sexually transmitted diseases especially HIV/AIDS a disease that the society and the Kenyan government at large is working hard to eliminate.

According to Lorch (2006), alcohol use is shown frequently in Television programs with these programs typically portraying alcohol use as a normative, problem free adult behavior. Studies suggest that exposure to TV content in which characters consume alcohol can influence those behaviors in teen audiences. Sargent et al. (2006) found that natural exposure of children aged 10 to 14 years to motion pictures with prominent drinking scenes predicted non-drinkers' initiation of drinking within the next eighteen months. Similar results were found by Dalton and Colleagues (Glantz, 2002), and the primary explanation for both sets of results is that television and movies typically show highly attractive characters drinking with very few negative consequences of alcohol consumption.

Thus children who frequently watch television programs are relatively likely to view the world as mean and threatening, engage in pre-marital sex and to view drinking alcohol as a normal part of life. TV programs that contain any of this content have attracted ratings. However rating these programs would only be effective if parents understand the meaning and function of these ratings.

### *1.1.2 The Social Cognitive Theory*

Albert Bandura, a Professor of Social Science in Psychology at Stanford University and one of the most influential psychologists asserts in his 1977 Social Cognitive Theory that children learn various social behaviors by observing those exhibited by others. Bandura (1977) in this theory, states that factors that increase a child's likelihood of trying a behavior include whether the child can identify with the person exhibiting the behavior and whether the model succeeds in achieving a given goal or earning a reward. Heavy exposure to television characters that succeed in achieving their set goals by behaving in aggressive, violent, or stereotypical ways may encourage the child viewing them to apply similar strategies in his/her own live (Bandura, 2002).

There is sufficient evidence from various studies that heavy exposure to televised violence is interconnected with increased aggressive behavior in children and adolescents. Wagner (2001) citing Gostz (1974) confirms the assumption that professional killers on TV are often glamorized as heroes. He argues that when a child views a hero of a program kill and injure people to achieve his goal, and this child does not bother to question the means by which the hero reached his goal, this can easily make

this child believe that the only way to achieve his/her goals is through violence.

Wargner (2001) argues that there is too much violence and aggressive behavior presented on television today. This argument was confirmed by a study carried out by Thompson (2005) and her research group at the Harvard School of Public Health. Their study revealed that every one of the 74 animated feature films reviewed (100%) contained violence against another character. The pervasiveness of violent content on television combined with the vast scientific literature on media violence effects supports the notion that popular media plays a significant role in shaping social interaction that has both personal and societal consequences (Potts & Belden, 2009). That is why it is important to rate all television programs that contain violence so as to let parents know in advance that the TV program about to be aired contains violent content. But most importantly, parents need to know what these television content ratings mean so as to be able to implement parental guidance in practice considering the link between television violence and increased violence in children.

## 1.2 REVIEW OF RELEVANT STUDIES

### 1.2.1 Media advisory systems

It can be argued that the most common strategy for controlling undesirable influences of TV programs on children is to prevent them from gaining access to such programs. In the United States, restriction of minors' access to entertainment media deemed too mature for their consumption has taken the form of self-administered ratings in motion pictures, television, and videogames by respective industries (Bushman & Joanne, 2003; Gentile et al. 2005; Valenti, 2005). These advisory systems are intended to provide information to the public, with the ultimate responsibility for controlling minors' access to such media content placed primarily on parents or guardians.

The Motion Picture Association of America (MPAA) movie ratings system was the first self-imposed media advisory system and it is the most widely used. Some countries have lifted the MPAA movie ratings system and use it as it is, while other countries such as Kenya have slightly modified it. By slightly modifying it I mean that these countries use the MPAA movie rating system but just adjust a few things such as getting rid of the "PG" lettering that comes before the "13" in the PG-13 ratings criteria or replacing the "PG" lettering with "TV" lettering. This is the reason why it is important that before delving into TV content ratings systems, the origin and functionality of the MPAA movie ratings system is well understood.

### 1.2.2 The Motion Picture Association of America.

The Motion Picture Association of America (MPAA) movie ratings system was the first self-imposed media advisory system. Motivated by the several social, artistic, and legal changes occurring in the 1960s, the MPAA began assigning age-based ratings to movies in 1968. In the 1960s, movie producers were dissatisfied with existing studio censorship codes, the public wanted more honest movie depictions of social reality, and certain court rulings raised the possibility that individual state and local governments could legally regulate adult movie content in order to control minor children's access (America, 2011) because as Senator Margaret Chase Smith told the 89<sup>th</sup> Congress of America, "movies...are more adult than ever." p.44 (Burroughs, 1971).

On November 1, 1968, the MPAA together with the National Association of Theatre Owners (NATO) and the International Film Importers & Distributors of America (IFIDA) came up with the age-based movie ratings system as an effort to satisfy the above concerns (Valenti, 2000). This system allowed filmmakers to make the film they wanted and then this film would receive an appropriate rating (Leone & Bissell, 2005). The basic mission of the age-based movie rating system was to offer parents some advance information about movies so that parents could decide what movies they wanted their children to see or not to see. This placed the responsibility of restricting minor's access to adult movie content primarily on parents. The MPAA assigns five age-based rating categories to films:

**G:**General Audiences.

**PG:**Parental Guidance Suggested.

**PG-13:** Parents Strongly Cautioned.

**R:**Restricted.

**NC-17:**No One 17 and Under Admitted.

#### 1.2.2.1 From age-based ratings to content-based ratings

Even with the introduction of the age-based ratings by the MPAA, some people were still not satisfied. It did not take long before these critics of the age-based ratings system went public with their concerns. The National Parent Teacher Association president Joan Dykstra called these ratings confusing and insufficient. Edward Markey, the father of the V-chip legislation argued that the ratings system did not give parents the information they needed so as to make appropriate decisions for their own children, and that these rating system will not give parents the choices they need to block programming (Abelman & Gubbins, 1999). On September 27, 1990, the MPAA yielded to the American public pressure and introduced brief explanations (forewarnings) of why a particular film received its R-rating. This new ratings system was called the content-based ratings system. These forewarnings, MPAA believed, would go a long

way in helping parents know a little bit more about a film's content before letting their kids access it (Valenti, 2005).

Even with relative failure of the original age-based rating system noted, more and more critics are still not satisfied with the content-based rating system. Thompsons (2005) acknowledges that ratings reasons provide some information about the content thus making them far more superior than just giving parents the ratings alone with no explanation. However she feels that the ratings reasons do not tell all the parents about all of the types of content that children might experience. The ratings reasons should provide parents with more descriptive and accurate content-based information because different parents are concerned with different issues (Miller, 2005).

#### *1.2.2.2 Ratings Creep*

The MPAA rating system has further been accused to have overtime stretched the boundaries of what is considered acceptable in certain rating categories, a charge that is referred to as "rating creep". Jane (1978) predicted that in future MPAA will have to "loosen the 'criteria' for G or PG ratings, an alternative which might seriously jeopardize the industry's image, p.204." Based on the past studies and findings of this study that revealed that parents and children feel that television programs rated "PG" are loaded with sexual content I believe that we are living in that future. Various studies have revealed that 'ratings creep' has occurred over the last decade and that today's movies contain significantly more sexual content, violence and profanity on average than movies of the same age-based rating a decade ago (Snider, 2004; Miller, 2005; Thompson, 2005; Today, 2005; Williamson, 2009). This has been noted specifically in the PG, PG-13 and R categories.

The MPAA rating system has been accused of being more lenient with violence despite public opinion polls showing that American parents worry so much about violence in the media than about sex or bad language (Williamson, 2009). Wilson et al.(1997) found that PG-13 films can either contain multiple scenes of violence or have no violence at all but be loaded with vulgar language (Jenkins, Webb, Browne, & Kraus, 2005). Jim Isaac, the director of "Friday the 13<sup>th</sup>" movie, expressed surprise at what he perceived as the MPAA's leniency with the violence in his movie. This film which depicts a woman's face being frozen and smashed into pieces, two women getting beaten to death, and a man being sliced in half received an "R" rating. Jim Isaac said he expected that MPAA would urge him to take out a lot more in order to receive the "R" rating (Federman, 2002).

This 'rating creep' has led parents groups and politicians to cry out for fixation of this rating system because they argue that this

system is not working (Today, 2005).MichealMedved in a USA Today opinion column proposed that the industry changes the PG-13 category from its current status to R-13 so as to better alert parents that strong doses of material inappropriate for teens can be in these films. A survey by the National Institute on Media and the Family (2001) found that parents would rate movies much more strictly than the current system does (Lamb, 2001).

Stephen Farber looks at this leniency from a different but quite interesting angle; he argues that MPAA tends to rate films based on what adults find offensive, rather than using harmfulness to the children as a criterion. Thus movies containing sex and nudity receive more restrictive ratings than those containing violence because parents are more likely to be "disturbed" by sexual content (Williamson, 2009). There is hardly any documented research on child's knowledge and perception of PG-Rated television programs.

Some scholars however, argue that there is no such thing as rating creep. Former MPAA President Jack Valenti argued that as society changes, so do the ratings, "A PG-13 today might have been an R 15 years ago" (Today, 2005). The entertainment industry is including various obscene materials in programs meant for family viewing in the name of entertainment. We are in the next generation of media products, and it's time for the rating systems to come into this century so that they can be effective tools for today's parents. It is time, for industry to lead the charge in developing the next generation of media rating systems. This new ratings will only be effective if parents' and children's knowledge and views of the current PG-Ratings were known and considered while designing the new ratings.

#### *1.2.3 Television Content Ratings system*

The TV content ratings systems were put in place as a way of reducing media effects on children. This voluntary system of guidelines was aimed at providing parents with information to help them make informed choices about the TV programs that their children watch. America was the first country worldwide to implement the TV content ratings system in January, 1997. This American TV content ratings system was called the "TV Parental Guidelines" and it was based on the MPAA movie ratings system. This is the reason why it is important to understand the origin and of MPAA and how MPAA functions.

The American TV Parental Guidelines started off as an age-based ratings system, and just like the MPAA ratings system which initially had four ratings: G (General Audience), M (Mature Audiences), R (Restricted) and X (No one 17 and under admitted), the original TV parental Guidelines included four

ratings: TV-G (General Audience), TV-PG (Parental Guidance Suggested), TV-14 (Parents strongly cautioned) and TV-MA (Mature Audiences Only). With the exception of the addition of "TV" before each rating and a few minor changes in the ratings themselves, the TV Parental Guidelines were virtually identical to the movie ratings.

Just like with the MPAA age-based ratings system, the American public was not satisfied with this TV aged-based ratings system. Parents groups, media researchers, members of the congress, public health associations and media advocacy organizations argued that these ratings were not providing sufficient information for parents to make informed decisions about their children's viewing choices. In October 1997, the American television industry bent to public pressure and content categories were added to the age-based labels. These content categories are V (violence), S (sexual situations), L (coarse or crude language), D (suggestive dialogue, usually sexual), and FV (fantasy violence). The content categories are used as an addition to the age-based designations. Since the TV Parental Guidelines are based on the MPAA ratings system, we should expect the TV ratings to be just as informative as the movie ratings.

Although the ratings system is officially voluntary, all of the broadcast networks rate their programming, as do the vast majority of cable channels. With the successful implementation of a PG-Rating system in America, many European countries and a few Asian and African countries followed suit.

### 1.2.3.1 TV content ratings system in Europe

In Spain, members of the government and entities representing the four national television networks adopted a code on self-regulation of television content in 2004. This code classifies audiences by age-groups; Program particularly suitable for children, Program suitable for all audiences, Program not recommended for minors under age 7, Programs not recommended for minors under age 13, and Programs not recommended for minors under age 18 (Vivarta, 2006). In Netherlands, the Dutch institute for classification of audiovisual media which was established in 1999 regulates television content. This institute uses the following content-based ratings: Program suitable for all ages and children over age 6-may air at any time of the day, Programs recommended for children over age 12-may not air after 8:00 p.m., Programs recommended for viewers over age 16-may not air after 10:00 p.m. (Vivarta, 2006).

### 1.2.3.2 TV content rating systems in Africa

In Africa however, TV content rating systems seems like a far-fetched dream with South Africa being the only African country with a documented standardized ratings system. The Film and

Publication board issues and certifies the South African ratings whilst the various films and programs are regulated by the National Broadcasting Commission. All the TV stations must display the TV content ratings which include: *family* this is a program that is suitable for family viewing because it does not contain any obscenity, *PG* this a program that children under the age of 12 may watch but they must be accompanied by an adult, *13* this is a program that should not be watched by children under the age of 13, *16* this is a program that should not be watched by children under the age of 16 years old, *18* this is a programs that should not be watched by children under the age of 18 years old, and *R18* this is a reserve for films of an extreme sexual nature and may not be broadcast on TV. This ratings system also has additional symbols that include: D (Drugs), V (Violence), N (Nudity), P (Prejudice), and S (Sex) (Encyclopedia: Television rating system, 2011).

In Kenya, we have a TV content rating system that was put in place by the Kenya Film Classification Board (KFCB) in 2010. This ratings system that borrows much from MPAA uses four ratings categories; GE (General Exhibition)-the film contains nothing inappropriate for viewers; PG (Parental Guidance) - the film may contain scenes unsuitable for children under the age of 10 years. However parental guidance is recommended for children 10 years and above; 16-film may contain moderate or medium impact classifiable elements of an intensity and frequency that will be appropriate to the development of teenagers. Persons under 16 years are not allowed and; 18-the film may contain scenes suitable for persons above 18 years or adults only. The KFCB claims that it must examine and classify all films in the country either locally produced films or imported films, however not all TV station use these ratings system (www.kfcb.co.ke, 2010). At the time of this review most stations were using the MPAA ratings system at the time of this study.

### 1.3. Parents understanding of television content ratings system

The introduction of the TV content ratings system shifted the burden of controlling children's exposure to inappropriate programs from filmmakers and TV program managers to parents. Former US president George Bush argued that it is the parents' responsibility and not the government's when it comes to protecting their children from indecent TV programming (Abelman, 2007). However, for parents to be able to carry out this responsibility well, they must understand the TV content ratings system.

Three years after the introduction of the TV content ratings system in America, the Annenberg survey of 2000 revealed that only half of 1200 parents of children aged 2-to-17- years old were even aware of the ratings and only 39% of parents reported

using the ratings to guide their children's viewing (Schmitt, 2000). Fifteen years later, an American national internet-based survey conducted by Public Opinion Strategies and Hart Research Associates in late 2011 revealed that 93% of parents reported being aware of the TV ratings system, 88% of parents were aware that the TV ratings system provide guidance based on the age of the child, 82% of parents were aware that the TV ratings system provides information about the content of a program using letters (L for coarse, V for violence, etc), while 68% of parents reported using TV ratings system ([www.televisionwatch.org](http://www.televisionwatch.org)). This research revealed that parents in America have come to rely on the TV ratings system as a key tool in helping them monitor the TV content that their children are getting exposed to. However, there is almost no available literature on parent's knowledge and reception of TV content ratings systems in other parts of the world. It's important to note that any media ratings systems can only be truly effective when parents know that they are available, know how to use them, and when they provide accurate and descriptive content-based information.

Previous studies have established that there are various factors that affect a parent's interest and understanding of TV content ratings system. These factors include but are not limited to: a parent's perception towards TV effects, a parent's level of education, a child's age and gender, family composition and the parent's viewing habits. These are briefly reviewed next.

#### *1.4 Parental perceptions of television effects.*

A parent's perception of TV's impact on his/her child is one of the most prominent factors that are likely to contribute to the amount of Parental control of home-televiwing (Abelman & Gubbins, 1999). According to Mills and Watkins (1982) and Bybee, Robinson, & Turow, 1982 there is a clear relationship between parents' awareness of possible effects of televiwing and subsequent enforcement of rules at home. These scholars found out that one of the reasons for lack of parental mediation was that many parents did not perceive TV to be a harmful or beneficial force in their children's lives (Abelman & Gubbins, 1999).

##### *1.4.1 Educational Levels*

Maternal education is consistently found to be inversely related to children's television viewing (Hesketh, Ball, Crawford, Campbell, & Salmon, 2007). There is almost no documented research on whether there is any relationship between parents' education levels and children's television viewership. There is almost no documented research on whether there is any relation between a parent's level of education and his knowledge of PG-Ratings. And whether there is any relationship between a

parents' level of education and their consideration of PG-Ratings in program selection for children.

##### *1.4.2 Child's Age and/or Gender*

According to the FTC Report, children noted differences in their parents' attitudes and behavior towards TV viewership in the home depending on the child's age. Parents tend to give older children more freedom regarding the selection and use of entertainment products than they give younger children (Grier, 2001). This could be because parents assume that older children are mature enough to distinguish between fact and fiction, and that these children are capable of making informed decisions.

##### *1.4.3 Parent's viewing habits*

According to a study carried out in Ankara, Turkey by Yalcin, Tugrul, Nacar, Tuncer, & Yurdakok (2002) parental viewing habits had an influence on their children especially those aged 3-6 years. This study established that the longer a parent watched TV, the longer the child too. This is true because young children tend to look for affection from their parents thus they are always hovering around their parents. Thus if a parent spends much time on TV, there is a likelihood that the child will accompany his/her in viewing.

##### *1.4.4 Family Composition*

Family composition could be another reason why children are getting exposed to inappropriate TV programs. Older siblings are likely to watch more adult programs, and in most cases they watch these programs with the younger ones. Yalcin, Tugrul, Nacar, Tuncer, & Yurdakok (2002) argue that the amount of time sisters and brothers spent watching TV had an impact on preschool as well as primary school children. However there is no documented literature on whether this is true in Kenya, my study confirms previous findings that older siblings influence the preschool and primary school children into watching age inappropriate TV programs as discussed in detail in chapter 7 below. Parents watching habits are also contributing to children watching inappropriate programs. If a parent watches too much television, there is a likelihood that their children will watch with them most programs. However, this is an area that calls for further investigation.

#### *1.5. Implementation of Parental Guidance on television programs*

A substantial body of research indicates that parents have the potential to influence their children's media consumption patterns, interpretations and acceptance of media content. Parents can affect their children's TV use through intervention. However

very few parents get directly involved or actively exercise control over their children's selection, consumption and interpretation of television information (Abelman & Gubbins, 1999). This could be because of the current nature of our fast moving world whereby both parents have to work full-time, take time on the road commuting back home, prepare dinner, etc. Such parents will be lucky to have an hour at the end of the day to spend with their children. Meanwhile children arrive home from school as early as midday, well before any adults and studies have revealed that most children use their free time watching TV.

According to the Centre for Screen Time Awareness, American children aged between 2 and 7 years spend less than 20% of their TV viewing time alone and unsupervised (Alert, 2008). In Morocco, children spend most of their time watching TV unsupervised (Chebbak, 2012). This could be dangerous because of ratings creep. Studies have shown that if a child spends more than 2 hours on TV, TV becomes a potent source of information to the child (Yalcin, Tugrul, Nacar, Tuncer, & Yurdakok, 2002). And as earlier discussed, parents are very concerned about "rating creep". Different parents have come up with different ways of implementing parental guidance in practice considering the varied nature of television programs and children's interests. All these different ways can be grouped into three broad categories; restrictive mediation style, active mediation style and co-viewing mediation style as reviewed below.

#### *1.5.1 Restrictive mediation style*

Some parents use the restrictive mediation whereby they prohibit the viewing of some programs. According to Abelman and Pettey (1989), this type of mediation would be employed by parents who were primarily concerned about the behavioral effects of TV (Abelman & Gubbins, 1999). These parents would most likely limit their children's access to specific TV programs or channels that are perceived to be inappropriate (Abelman, 2007). These parents choose the time and channels that their children can tune into.

#### *1.5.2 Active/Instructive mediation style*

Other parents use the instructive mediation style. This is whereby they purposefully discuss and/or critic a certain program's content and its effects. A study carried out by Yalcin, Tugrul, Nacar, Tuncer, & Yurdakok (2002) found out that 42.7% of parents with children aged 3-6 years old and 26.4% of those with children aged 7-11 years discussed TV programs and content with their children. This mediation style is mostly used by parents who are more concerned with cognitive and/or affective level effects, that is, those parents who perceive the medium to

influence what children think about and their thought processes, and also the medium influencing how children feel about themselves and others (Abelman & Gubbins, 1999).

#### *1.5.3 Co-Viewing mediation style*

Some parents use the co-viewing mediation style. This is whereby parents view a TV program with their children but do not agree or disagree with the TV message, the TV characters and acts. However, as the number of TV channels increased over the years, parental control over television and family co-viewing dramatically decreased (Abelman & Gubbins, 1999). The cost of living can also be argued to be one of the reasons as to why family co-viewing has decreased, this is because both parents are forced to go out to fend for the family, and in some extreme cases they come back home after dark, thus they do not have time to co-view programs with their children. This thus calls for the incorporation of advisory ratings into the rules and regulations about TV in the home.

#### *1.6 Children's interpretation of parental mediation behavior.*

In any discussion of parent's interaction with their children and the possible outcome of these activities, it is important to point out that children are not mere passive recipients of parenting practices. Children have an active role in parent-child interaction yet there is hardly any literature on whether children even acknowledge that their parents engage in mediation at all. Very little has been documented about how children interpret their parents' mediation messages (Nathanson, 2002). The effectiveness of mediation should depend on how children understand these messages.

Studies in America established that restrictive mediation was related to less positive attitudes towards parents and more positive attitudes towards the forbidden content. Active mediation was found to mitigate possible negative outcomes because when children hear from parents about their own interpretations of television content, it increases the child's ability to be skeptical about television content. Co-viewing can create hostilities in children (Nathanson, 1999; Nathanson, 2002). There is almost no literature on whether children in other parts of the world especially Africa and particularly Kenya acknowledge that their parents engage in any mediation practice.

#### CONCLUSION

Generally, this review has established that apart from America there is hardly any insight; 1) in parent's knowledge and perception of TV Content Ratings Systems put in place in various countries worldwide; 2) on factors that affect parents' interest, understanding and implementation of TV Content Ratings System; 3) into how parents implement parental guidance in practice given the varied nature of TV programs; 4)

on the different aspects that determine the type of mediation that different parents employ; 5) on whether children in other parts of the world especially Africa and particularly Kenya acknowledge that their parents engage in any mediation practice and 6) on how children in other parts of the world and interpret their parents' mediation messages. Therefore there is need for further research in the above mentioned six areas in the media effects area of journalism studies.

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# DEGRADATION OF CARCINOGENIC DYES FROM EFFLUENTS OF DYEING INDUSTRIES USING COPPER NANOPARTICLE.

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**Abstract:** The study emphasizes the use of oxidation resistant copper Nano particles as an efficient tool for the degradation of organic dyes contained in effluents from textile dyeing and printing industries. The synthesis of Copper Nano particles was done using modified surfactant assisted chemical reduction process in an aqueous solution. The synthesis was optimized using varying concentrations of reactants and reaction time intervals, monitored simultaneously by UV- Visible spectroscopy and Dynamic Light Scattering (DLS) measurements. The synthesized nanostructures were finally characterized for their size distribution using DLS. These Cu Nano particles have been used as a heterogeneous catalyst for the comparative reductive degradation of commercial samples of methyl orange (MO) and aniline yellow (AY) in the presence of sodium borohydride (NaBH<sub>4</sub>) used as a potential reductant. Cu NPs were used for reductive degradation of samples containing dyes collected from the drains of different local textile dyeing units of Delhi NCR region as well as different textile industries of Jodhpur region of Rajasthan. The degradation studies were conducted using UV- Visible spectroscopic methods.

Key Words: Copper Nano particles, Dye degradation, effluent treatment.

## 1.Introduction

Textile dyeing industry is one of the industry which is under strong scrutiny of environmental agencies. The waste water obtained from textile industries are increasing becoming a problem for the environmentalists, since it is one of the major sources of water pollution.[1] The nature of pollution caused by this industry is primarily due to non-biodegradable nature of dyes. The dyes undergo chemical changes under various environmental conditions and transformed products may be more toxic and carcinogenic than the parent molecule.

Actually, the industrial waste water effluents containing dyes are a major threat to the environment because of their carcinogenic nature. Up to 50% of the dyes may be lost directly into the water ways due to inefficient and uneconomic dyeing techniques. These dyes should not be released in water directly as they are persistent, carcinogenic and recalcitrant in nature and hence are highly problematic for aquatic systems. [2] Dyes released in waste water may also undergo incomplete anaerobic degradation, inducing additional toxicity caused by cancerous end products. Besides this, the intense colour of the dyes reduces the penetration of sunlight and dissolution of oxygen in water which is a considerable threat to the aquatic ecosystem.[3] Due to the increasing strict regulations and legislations regarding waste water management, it is required to find greener, efficient and economically viable ways for waste water treatment. The conventional routes include adsorption, coagulation, ozonation and biological routes[4]. However these methods are time taking, expensive and inefficient, resulting in secondary pollution.

Advanced oxidation processes [5] employing metal oxides are being adopted as technically feasible degradation processes but are proving to be expensive, inefficient and impractical. Recently multistep processes [6] for dye degradation have been reported. Among such processes, the use of metal Nanostructures for the reductive degradation of the organic dyes is not only a convenient degradation system viable in terms of efficiency and cost effectiveness but also environmental friendly as it provides biodegradable end products like aromatic amines, which are readily and easily degraded by microorganisms [7]. Transition and noble metals based nanoparticles viz. Palladium nanoparticles, cysteine capped gold nanoparticles, hydrogel capped Silver nanoparticles and Platinum nanoparticles are also being explored for reductive degradation of dyes [8] but due to the difficulty in their availability and high cost, their application in larger volume production is restricted. An alternative to this is the use of a cheap metal like copper, which because of its easy availability, low cost and higher thermal & electronic conductivity is preferred over the traditional noble metals like platinum and gold [9].

The research study in the project was targeted towards the application of copper nanostructures as a catalyst for waste water remediation. Cu nanostructures capped with an organic protecting group, sodium dodecyl sulphate were used since pure copper nanostructures are prone to oxidation and aggregation.

## 2.Experimental

**Materials:** All analytical grade chemicals were used. Copper(II) Chloride  $\text{CuCl}_2 \cdot 5\text{H}_2\text{O}$ , Ascorbic acid, Sodium dodecyl sulphate (SDS), and Sodium borohydride ( $\text{NaBH}_4$ ) were purchased from Sigma Aldrich. Throughout the experiment, Millipore filtered, deionized water was used.

**Methodology:** Synthesis of oxidation resistant copper nanoparticles was performed as reported earlier (9b). Optimization of synthesis procedure was carried out to obtain best nanoparticles that could interact with dye samples.

**Preparation of Copper Nanostructures:** Surfactant capped copper nanostructures (Cu NPs) were synthesized via an aqueous reduction route. However, slight changes in the optimum amount of precursor ingredients were made to obtain best Nanosize particles with maximum catalytic performance.

### Optimization of synthesis of Cu NPs

**Varying the amount of  $\text{CuCl}_2$ :** Volume of SDS = 1ml, Volume of Ascorbic acid= 0.1 ml, Volume of water = 5 ml, Volume of  $\text{NaBH}_4$  = 0.4 ml

Volume of $\text{CuCl}_2$ used in ml	Size nm	PDI	CR
0.2	247.0	0.475	91.8
0.3	148.7	0.225	497.4
0.4	120.4	0.434	368.2
0.5	123.7	0.276	285.9
0.6	125.8	0.251	348.7

**Varying the amount of  $\text{NaBH}_4$ :** Volume of SDS = 1ml, Volume of Ascorbic acid= 0.1 ml, Volume of water = 5 ml, Volume of  $\text{CuCl}_2$  = 0.4 ml.

Volume of $\text{NaBH}_4$ used in ml	Size nm	PDI	CR
0.4	203.2	0.275	599.1
0.5	264.1	0.289	157.7
0.6	239.4	0.297	150.4
0.7	1412	1.000	327.5

In the typical synthesis of copper nanoparticles, optimized amounts of ingredients were used. 0.4 mL of 0.02 M Copper (II) chloride salt ( $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ ) was taken in a test tube. To this was added 1 ml of 1.0M sodium dodecyl sulfate (SDS) followed by the addition of 0.1mL of 0.1M ascorbic acid (vitamin C). 5 ml of Millipore filtered, deionized water was added to the mixture volume was adjusted to 9.0mL with deionized water and finally 0.4 mL of 0.01M sodium borohydride ( $\text{NaBH}_4$ ) was added slowly. To ensure complete reduction and capping of copper nuclei after reduction, reaction was allowed to proceed for about 15 min.

For carrying out feasibility studies, the above procedure was followed. But for determining the percentage degradation of the effluents, Nanoparticles were concentrated in Centrifugation machine. Solutions were prepared by the following method. Copper Chloride solution:0.493g of  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  was dissolved in 50 ml of Millipore water. **SDS:**7.2g of SDS was weighed and dissolved in 50ml of Millipore water with continuous heating (around  $40^\circ\text{C}$ ) and stirring on magnetic stirrer till it dissolves completely. **Ascorbic acid:** 1.38g of Ascorbic acid was taken and dissolved in 50ml of Millipore water.  **$\text{NaBH}_4$ :** 0.03g of  $\text{NaBH}_4$  solution was made in 50ml of Millipore water. After the preparation of respective solutions, Copper nanoparticle were synthesized by taking 0.4ml of  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  solution in a flask followed by addition of 1ml of SDS, 0.1ml of Ascorbic acid. It is further diluted by adding 9ml of Millipore water and after that 0.4ml of  $\text{NaBH}_4$  was added slowly to the solution and the solution was left for 15minutes. For homogenous mixing the solution was placed on a vortex for 1minute. **Concentrating the Copper nanoparticle via centrifugation:** For getting a concentrated solution of Cu NPs, the solution was centrifuged at 10,000rpm for 1 hour in the centrifugation machine. After this the excess of water was removed to minimize the dilution factor in the spectra.

### Sampling

- Samples of pure commercial dyes commonly used in textile industries were procured from market.
- Samples of effluents were collected from:
  - (i) Textile dyeing units in Delhi NCR region
  - (ii) Textile dyeing and printing industries in and around Jodhpur.

### 3. Results and Discussion

Characterization: Dynamic Light Scattering measurements were performed on obtained oxidation resistant Copper Nanoparticles during synthesis optimization. Measurements on surfactant capped CuNPs obtained using varying concentration of Copper(II) Chloride are summarized in Table 1 and Figure 1. Using 0.4 ml Copper(II) chloride in a typical synthesis, experiment affords smallest nanoparticles with a hydrodynamic diameter of  $\sim 122$  nm correlating to the actual size of  $\sim 50$  nm and a narrow size distribution.

Table 1 DLS measurements of copper nanoparticles in aqueous medium

S. No.	Sample	Size (nm) $\pm$ SD	PDI <sup>a</sup> $\pm$ SD
1	0.2 $\text{CuCl}_2$	$269.5 \pm 122.5$	$0.426 \pm 0.129$
2	0.3 $\text{CuCl}_2$	$149.3 \pm 0.656$	$0.232 \pm 0.006$
3	0.4 $\text{CuCl}_2$	$121.9 \pm 2.186$	$0.243 \pm 0.004$
4	0.5 $\text{CuCl}_2$	$125.9 \pm 0.666$	$0.252 \pm 0.012$

<sup>a</sup>PDI: polydispersity index is a measure of the width of the particle size distribution.

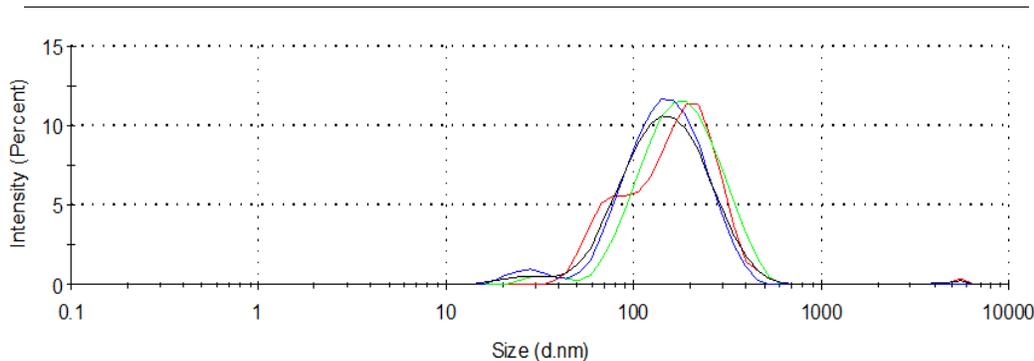


Figure 1: Size distribution graph of generated nanoparticles using varying concentration of  $\text{CuCl}_2$

### Degradation study of commercial dyes using synthesized Cu NPs

Catalytic activity of synthesized copper nanoparticles in degradation of methyl orange has already been explored. Spectroscopic methods particularly based on UV-Visible spectroscopy form the basis of such studies due to the fact that organic dyes depict strong and sensitive signals in the visible spectral region. Hence we recorded the UV-Visible spectra of commercial samples of methyl orange and aniline yellow while interacting with increasing concentration of colloidal solutions of generated surfactant capped, oxidation resistant CuNPs to monitor their efficiency. The spectra are depicted in Figure 2. Significant decrease was observed in  $n-\pi^*$  peaks at 464 nm and 450 nm of methyl orange, and aniline yellow respectively. These longer wavelength absorption peaks at 464 and 450 nm correspond to the absorption of azo group [10]. The finding indicates the probable attack on azo group in the dyes by reductive capped nanoparticles.

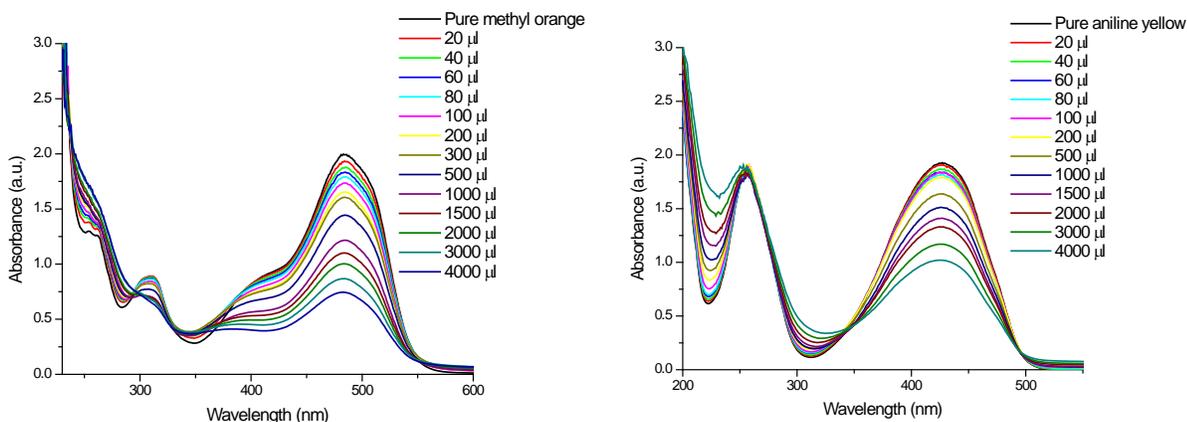


Fig. 2: UV-Visible spectra of aqueous solutions of commercial samples of methyl orange and aniline yellow recorded while an increasing volume of prepared colloidal solution of CuNPs was added to the stock solution of dye.

### Degradation of organic dyes present in real effluents from textile dyeing industries

The prime objective of the present work was to assess the feasibility of degrading organic dyes present in effluents of textile dyeing and printing industries towards development of an efficient and cost effective method for the same. Effluent samples were categorized in five batches each of which corresponds to a different source (Table 2).

Table 2

Effluent Number	Industrial Source	Wavelength (nm)	Absorbance in absence of Cu NPs	Absorbance after interaction with CuNPs	Percentage decrease in absorbance
E1	MSS industries Jodhpur	536	0.382308	0.084004	78%
E2	MSS industries Jodhpur	382	1.081925	0.357582	66.94%
E20	MSS industries jodhpur	521	0.6407544	0.1307764	79.59%
E25	MSS industries jodhpur	545	0.4094251	0.0806396	80.30%
E26	MSS industries jodhpur	349	1.305779	0.1817313	86%
E27	MSS industries jodhpur	382	1.372921	0.377789	72.48
E28	MSS industries jodhpur	380	1.225491	0.252253	79%
E6	Sirsa ,Haryana	493	0.116156	0.02981	74.33%
E7	Sirsa ,Haryana	514	0.126382	0.035927	71.57%
E22	Sirsa ,Haryana	383	1.302854	0.2578402	80%
E3	SHR industries Jodhpur	444	0.408678	0.08758	78.56%
E8	SHR industries Jodhpur	355	0.677771	0.613833	9.40%
E11	SHR industries Jodhpur	585	0.240269	0.079667	66.84%
E12	SHR industries Jodhpur	550	0.138079	0.035344	74.40%
E24	SHR industries jodhpur	499	0.662383	0.1212142	81.70%
E5	Paschimvihar , Delhi	388	0.224167	0.059837	73.30%
E21	Paschimvihar , Delhi	486	0.3948481	0.07271005	81.59%
E23	Paschimvihar , Delhi	515	0.4144294	0.08315547	79.93%
E29	Moolchand industries Jodhpur	536	2.512588	0.67499	73.13%
E32	Moolchand industries Jodhpur	385	1.63992	0.410185	74.98%

Initially degradation study was performed using prepared colloidal solutions of SDS capped Copper Nanostructures with a similar methodology as used for pure dye samples. Figure 3 shows two such representative UV-Visible spectra recorded on Effluents 22, from Sirsa Haryana and Effluent 24 from SHR industries, Jodhpur. Significant decrease was observed in absorbance peak at ~375 nm and ~500 nm for E22 and E24 respectively on gradual addition of prepared copper nanoparticles.

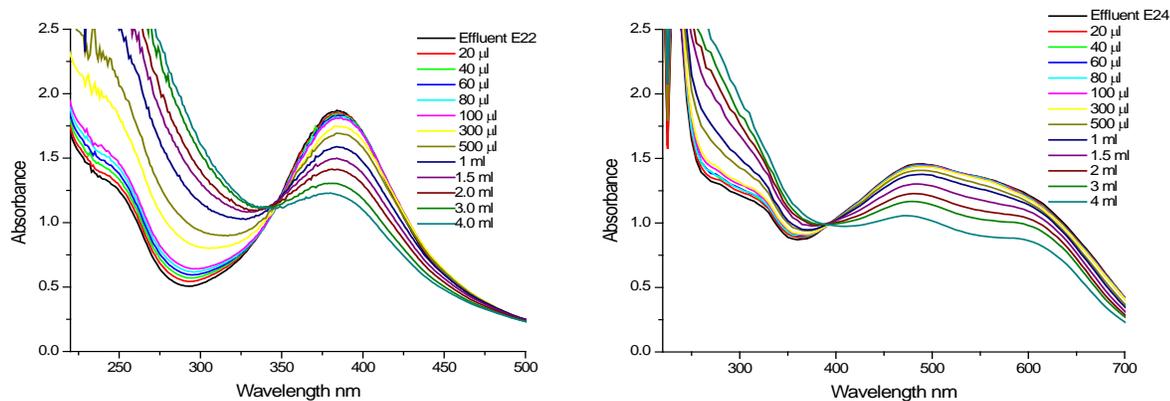
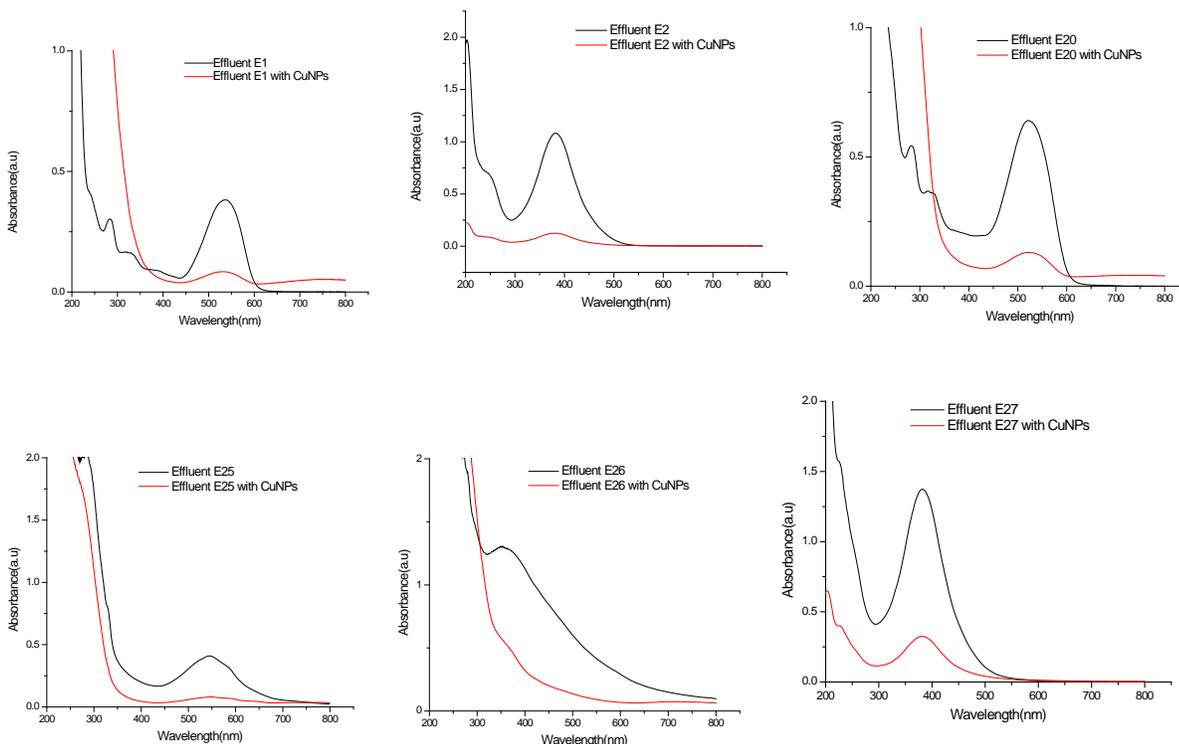


Figure 3: UV-Visible spectra diluted samples of E22 and E 24 while an increasing volume of prepared colloidal solution of CuNPs was added to them.

Since the CuNPs were added to effluent samples as colloidal solutions, possibility of a dilution factor instead of degradation, contributing to the decrease in absorbance value cannot be ruled out. Hence the colloidal dispersions were centrifuged for 2 hours at 10,000 rpm and the concentrate containing copper nanoparticles was interacted with effluent samples from all the five batches. The UV- Visible spectra recorded after interaction are compared with those of pure effluents in Figure 4 (a-e). These UV-Visible spectra were used for calculating percentage degradation of dyes by measuring the absorbance at maximum wavelength for each effluent before and after treatment with SDS capped CuNPs. The results are summarized in Table 2.



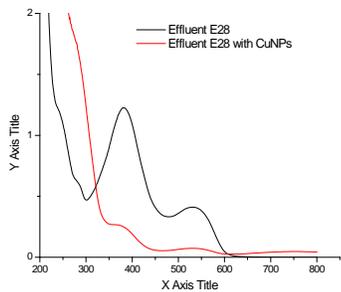


Figure 4a: UV-Visible spectra of Batch I effluents from MSS Industries Jodhpur before and after interaction with SDS capped CuNPs are depicted with black and red lines respectively.

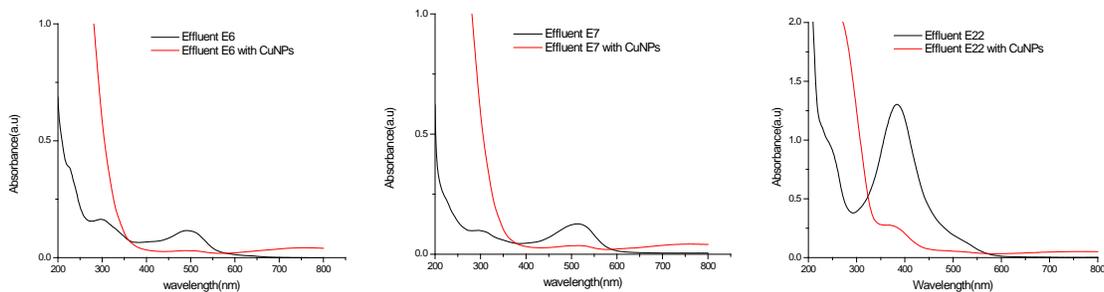


Figure 4b: UV-Visible spectra of Batch II effluents from domestic dyeing unit in Sirsa, Haryana, before and after interaction with SDS capped CuNPs are depicted with black and red lines respectively

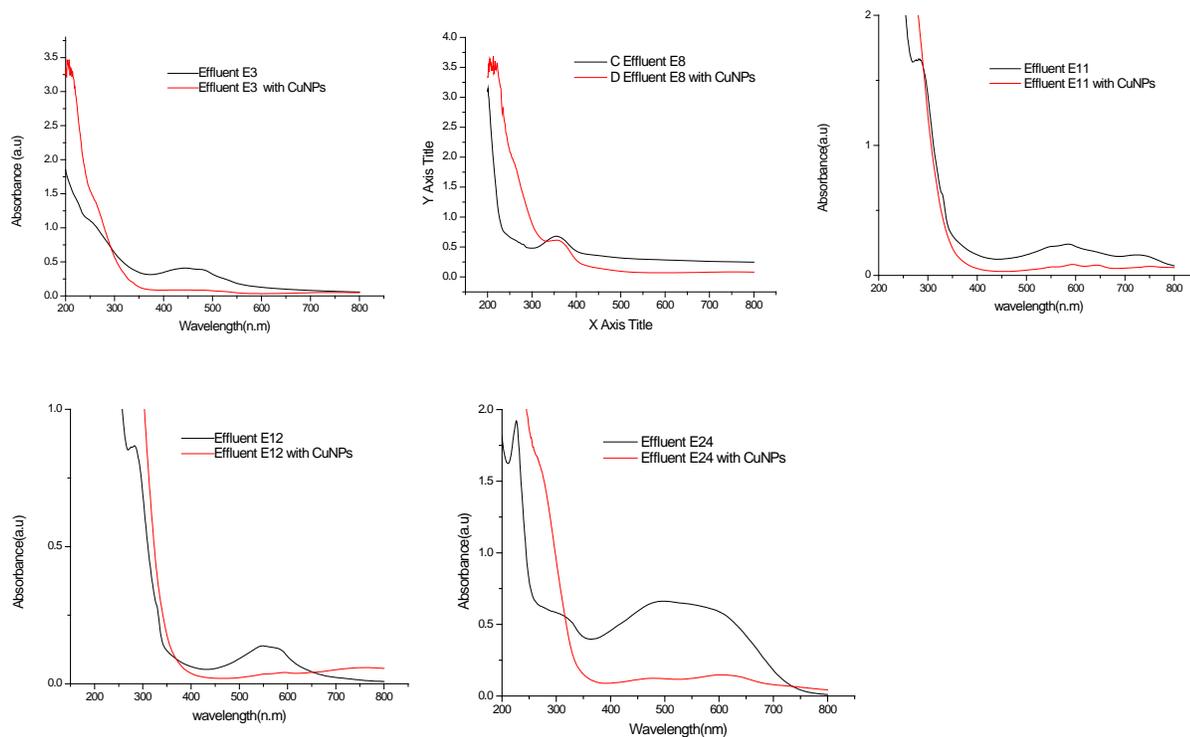


Figure 4c: UV-Visible spectra of Batch III effluents from SHR Industries, Jodhpur before and after interaction with SDS capped CuNPs are depicted with black and red lines respectively

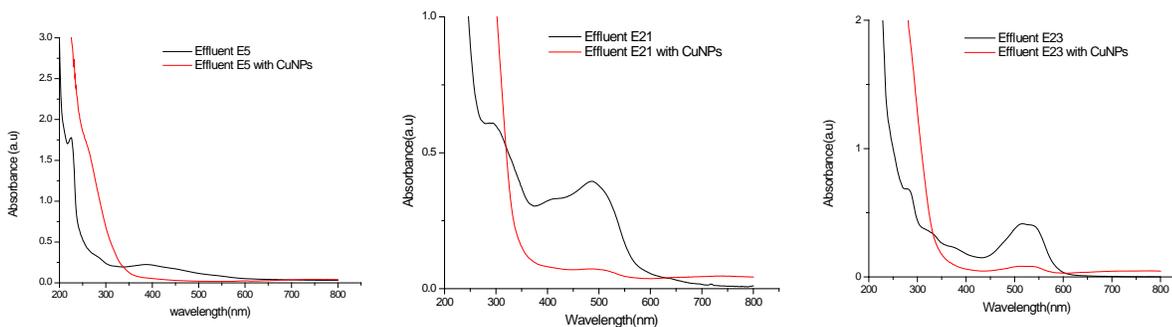


Figure 4d: UV-Visible spectra of Batch IV effluents from Delhi NCR region before and after interaction with SDS capped CuNPs are depicted with black and red lines respectively

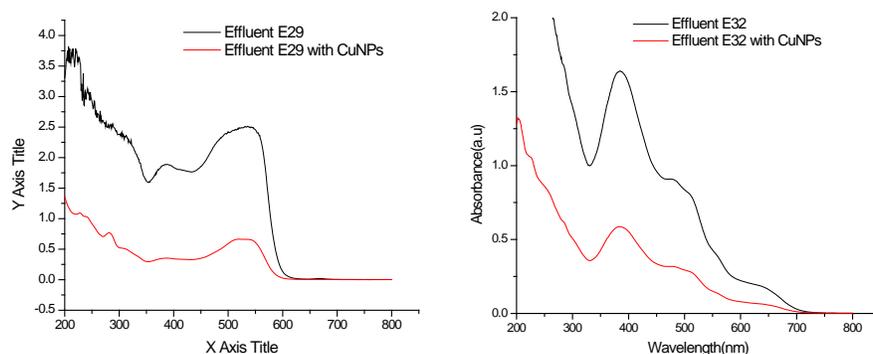


Figure 4e: UV-Visible spectra of Batch V effluents from Moolchand Industries Jodhpur before and after interaction with SDS capped CuNPs are depicted with black and red lines respectively

The effluents from MSS industries Jodhpur carried a high concentration of organic dyes absorbing between 350 to 580 nm, as is clear from their high OD values. 72- 86 % dyes could be successfully degraded by the generated copper nanoparticles. Batch II effluents from Sirsa, Haryana however showed lesser concentration of dyes, but once again absorbing in the same region, between 380 to 520 nm which could also be degraded by the nanoparticles from 71 to 80%. In Batch III effluents, Effluent E8, depicting a  $\lambda_{max}$  of 355 nm, showed only ~ 9.4% dye degradation. It appears that E8 had lesser/no concentration of azo dyes and hence it is indicated that SDS capped nanoparticles largely act on azo dyes. Rest of the effluents from SHR industries, Jodhpur showed 67 to 80 % degradation. Batch IV and Batch V achieved 73% to 84% and 73% to 75% dye degradation respectively.

#### 4. Conclusions

The present study has validated that CuNPs which have been demonstrated as heterogeneous catalysts for reductive degradation of methyl orange can effectively and rapidly degrade organic dyes present in effluents of dyeing and printing industries. The ultraviolet spectroscopic studies conducted on effluents and commercial dye samples, aniline yellow, and methyl orange indicated that SDS capped CuNPs attack the chromophoric azo linkage in the dyes. The reductive cleavage of azo linkage in dyes by AgNPs has also been reported recently. The present study can be extended to become a cost effective and efficient method for removal of hazardous and carcinogenic dyes from effluents of textile dyeing industries..

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# Distribution of bone metastases in prostate carcinoma; Isotope (Technetium 99m methylene diphosphonate) bone scans in a Sri Lankan population

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**Abstract-** Prostate cancer occupies a prominent place among malignant neoplasia of the genitourinary tract, and currently represents the most common neoplasia, being the second most frequent cause of death by cancer in men. Besides PSA, prostatic acid phosphatase, alkaline phosphatase, tumor ploidy, Gleason score, ultrasonography, computed tomography, magnetic resonance imaging, and bone scintigraphy are useful in the work-up of patients with prostate neoplasia. Bone is a preferred, and sometimes the only, site for prostate cancer metastases, which occur in more than 80% of men with advanced prostate cancer. The objective of current study was to study the characteristics of bone isotope scan findings in the evaluation of bone metastasis in patients with prostate carcinoma.

A retrospective observational study was conducted using 213 subjects at the surgical unit at Teaching Hospital Peradeniya in combination with Nuclear Medicine unit. All patients diagnosed with prostate carcinoma who underwent bone isotope scan for the evaluation of bone metastasis from January 2009 to June 2016 were included in the study. Each Patient's bone scan findings were documented. Analysis was carried out using 20.0 version of the statistical package for the social sciences (SPSS). The commonest site of bone metastasis of prostate origin was vertebral column.

**Index items-**prostate carcinoma, bone isotope scan, bone metastasis, genitourinary tract

## I. INTRODUCTION

Prostate cancer occupies a prominent place among malignant neoplasia of the genitourinary tract, and currently represents the most common neoplasia, being the second most frequent cause of death by cancer in men. Besides PSA, prostatic acid phosphatase, alkaline phosphatase, tumor ploidy, Gleason score, ultrasonography, computed tomography, magnetic resonance imaging, the bone scintigraphy is also a useful investigation in the work-up of patients with prostate neoplasia (Kanthilatha et al., 2015). Bone is a preferred, and sometimes the only site for prostate cancer metastases, which occur in more than 80% of men with advanced prostate cancer (Fred et al., 2002). The objective of current study was to study the characteristics of bone isotope scan findings in the evaluation of bone metastasis in patients with prostate carcinoma.

## II. PATIENTS AND METHOD

A retrospective observational study was conducted using 213 subjects at the surgical unit at Teaching Hospital Peradeniya in combination with Nuclear Medicine unit. All patients diagnosed with prostate carcinoma who underwent bone isotope scan for the evaluation of bone metastasis from January 2009 to June 2016 were

included in the study. Each Patient's bone scan findings were documented. Analysis was carried out using 20.0 version of the statistical package for the social sciences (SPSS).

### III. RESULTS

The study comprised of 213 patients with mean age of 68.77 years (SD±8.92). In the study population 46 % (n=98) of the patients were found to have bone metastasis in isotope scan, 50.2 % (n=107) did not have bone metastasis in isotope scan and in 3.8 % (n=8) bone scan findings were inconclusive.

Of the sites of bone metastasis commonest site was vertebrae 83.7% (n=82), pelvis 62.2%(n=61), ribs 59.2%(n=58), sternum 30.6%(30), skull 21.4%(n=21), femur 29.6%(n=29), mandible 7.1%(7) and other sites 19.4%(n=19). Other sites included shoulder joint, tibia, clavicles, knee, scapula, sterno-clavicular joint, orbital area and zygomatic bone.

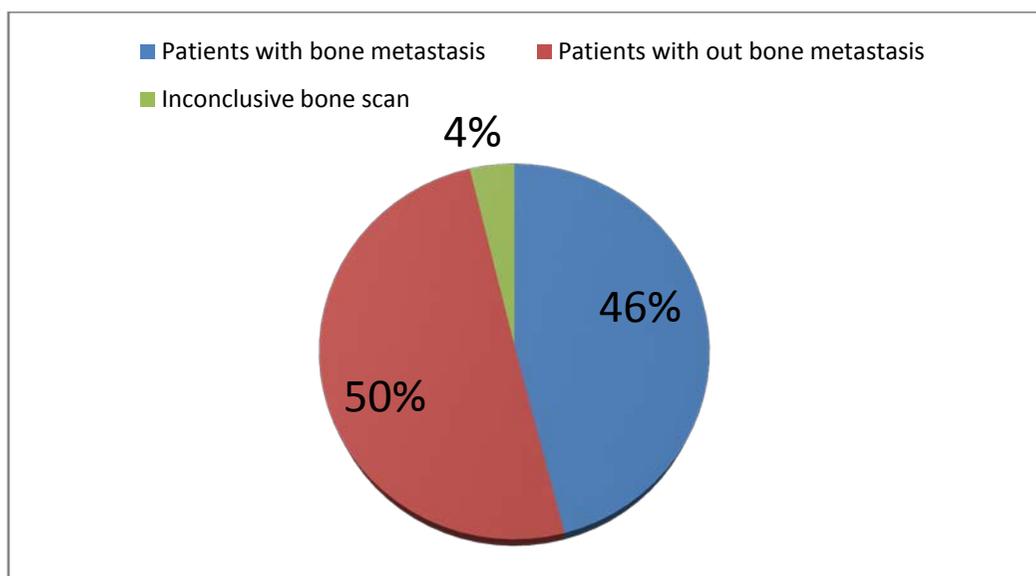


Figure 01- Obtained bone scan results

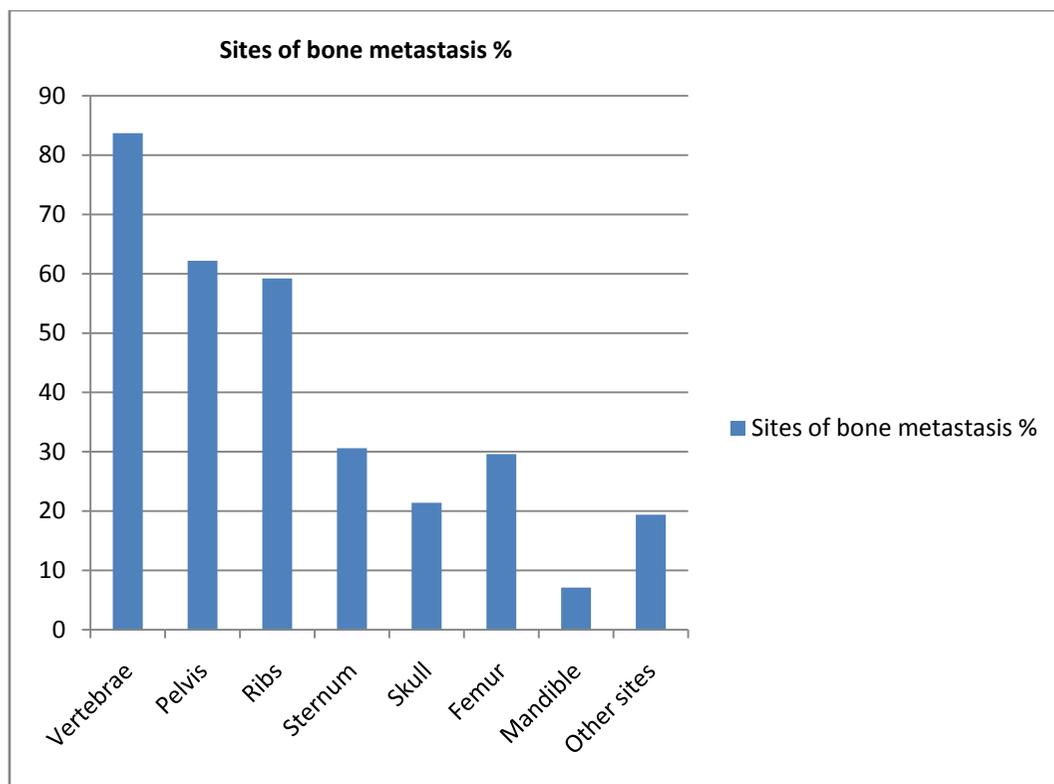


Figure 2- Sites of bone metastasis

#### IV. DISCUSSION

Bone metastases most commonly affect the axial skeleton, which contains red marrow in an adult. Properties of the circulation, cells, and extracellular matrix within this region could assist in the formation of bone metastases. Venous blood from the breasts and pelvis flowed not only into the venae cavae but also into a vertebral-venous plexus of vessels that extended from the pelvis throughout the epidural and perivertebral veins. The drainage of blood to the skeleton via the vertebral-venous plexus may explain the tendency of prostate cancers to produce metastases more commonly in the axial skeleton and limb girdles (Coleman, 2006).

Adenocarcinoma of the prostate spreads most commonly to the well vascularized areas of the skeleton such as the vertebral column, ribs, skull, and the proximal ends of the long bones. Prostate carcinoma cells have been believed to gain access to the vertebral column and ribs via the Batson venous plexus, which is a low pressure, high volume plexus of vertebral veins that join the intercostal veins. (Carlin, 2000).

Our study findings are also similar to the international literature. In our study the commonest site of prostate cancer metastasis were in the vertebrae followed by pelvis, ribs, sternum, skull, femur, mandible and other sites. Though literature showed that upper limb girdle is also a common site for metastases, our study has shown less number of patients with metastasis in shoulder joints, clavicles, scapulae and sternoclavicular joints.

## V. CONCLUSION

The commonest site of bone metastasis of prostate origin was vertebral column.

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# Utilization of Waste Material RHA in to a Mesoporous Material SBA-16

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**Abstract:** Spherical particles of mesoporous silica SBA-16 with cubic Im3m structure were synthesized at low pH using Pluronic F127 as template and RHA as silica source. The diameter of the spherical particles can be controlled in the range of 0.5–8  $\mu\text{m}$  by varying Spherical particles of mesoporous silica SBA-16 with cubic Im3m structure were synthesized at low pH using Pluronic F127 as template and RHA as silica source. It is suggested that this morphology transition is due to a change in hydrolysis and condensation rate of the silica source and as a result the assembly of F127 micelles will differ. The SBA-16 samples were characterized using powder X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and Nitrogen adsorption techniques.

**Keywords:** SBA-16; Spherical particles; Synthesis temperature; Morphology; Pluronic F127

## Introduction:

Spherical particles of mesoporous silica SBA-16 with cubic Im3m structure were synthesized at low pH using Pluronic F127 as template and RHA as silica source. The diameter of the spherical particles can be controlled in the range of 0.5–8  $\mu\text{m}$  by varying .The synthesis of mesoporous materials by a liquid-crystal template mechanism was reported (Beck J.S.,et al 1992, Kresge C.T., *et al*1992). The properties of these materials make them attractive for adsorption, catalysis, separation, chemical sensing, optical coating, drug delivery and electronic applications. For practical purposes, the overall morphology of a mesoporous material is a necessary requirement in combination with their internal structure. SBA-16 is a mesoporous material with 3D cubic pore arrangement corresponding to Im3m space group(BoissiereC.,*et al* 2001). In this body-centred-cubic structure each mesoporous is connected with its eight nearest neighbours to form a multidirectional system of mesoporous network (Sakamoto Y, *et al* ,2000), Due to its large cage, high surface area and high thermal stability. (Hudson SP., *et al*2008), this material appears to be one of the best candidates for catalytic support and packing materials for separation. Using F127 as a surfactant is the common way of synthesizing SBA-16(Zhao D., *et al* 1998, Van der Voort P. *et al* 2002). However, there are also reports on alternative surfactants such as F108 (Kipkemboi P., *et al* 2001), a blend of P123 and F127.

Micro porous zeolite are widely used as solid acid catalysts, ( Shaodian Shen, *et al* 2007)but their applications are intrinsically limited by drawback of zeolite is that the small size of the channels (less than 0.8 nm) and cavities (<1.5 nm) imposes diffusion limitations on reactions that can cause high back pressure on flow systems. The dimensions of the zeolite micro pores (< 2 nm), mesoporous (2-50nm) and macro pores (> 50 nm) permit faster migration of guest molecules in the host frameworks. Since fast mass transfer of the reactants and products to and from the active sites is required for catalysts (Kresge C.T.,*et al* 1992), the concept of infusing mesoporous into zeolite particles has attracted much attention. Recent progress involving this issued to ordered mesoporous materials such as MCM-41, SBA-16 and SBA-15. These mesoporous materials have pore diameters of 3.0 nm– 8.0nm and exhibit catalytic properties for the catalytic conversion of bulky reactants, but unfortunately, when compared with micro porous zeolite (Kecht J., *et al*, 2008 ), the catalytic activity and hydrothermal stability are relatively low, which can be attributed to the amorphous nature of the mesoporous walls. To overcome this problem, some recent research efforts have been concentrated on introducingmesoporous or macro pores linked to the zeolite micro pores. These materials calledHierarchical zeolite materials with combinations of micro/meso/macro pores would further extend the application of zeolite as solid acid (Van der Voort P., *et al* 2002) .

## Material and methods:

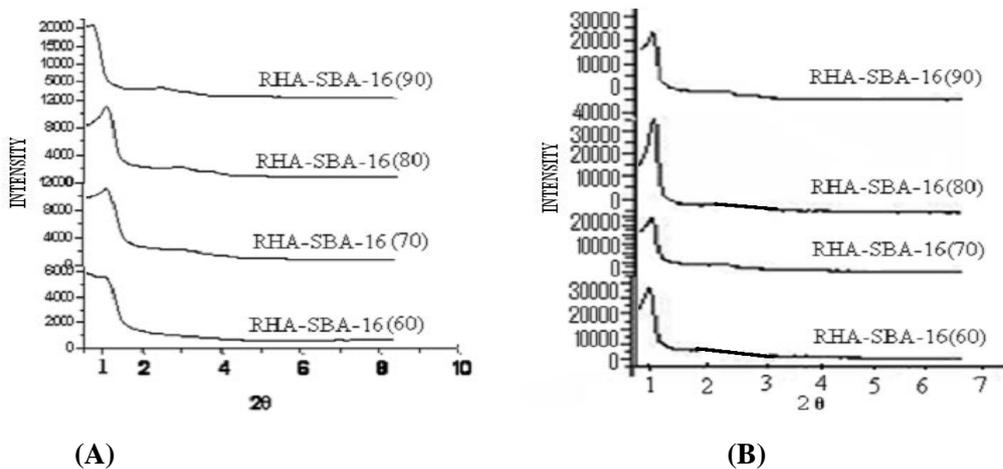
SBA composite with different concentrations have been prepared under acidic conditions in the presence of triblock copolymer F127 by using RHA as silica source 1.6gm of F127 was dissolved in 120gm of H<sub>2</sub>O, 5gm of conc. HCL and 7.5gm of butanol under magnetic stirring 1h to obtain homogeneous solution at 45<sup>0</sup>C to this solution 4.5gm of RHA was added. The mixture was stirred for another 24 hours .Ultrasonic treatment is given at power 70 for 30 min Then the solution is taken Teflon coated autoclave and hydrothermal treatment is given to 80<sup>0</sup>C for 24 hrs The synthesized mesoporous composite was filtered and dried in air .The sample is calcined at 1.5<sup>0</sup>C/ min .at 550<sup>0</sup>C for 6h (Carniato Fabio *et al* 2012).

**Result and discussion:**

**I) XRD-studies:**

As-synthesized forms of RHA-SBA-16 (60, 70, 80 and 90) exhibit a typical pattern with a very strong (110) reflection at low angle 1.14<sup>0</sup> and other weaker reflections as shown in Fig.1 A-(70, 80). According to Beck *et.al* these reflection lines can be indexed based on a hexagonal unit cell parameter ( $a_0 = \sqrt{2}d_{110}$ ). In the XRD pattern of the calcined RHA-SBA-16(60<sup>0</sup>C), only the (110) reflection is observed prominently .The presence of only (110) reflection in the calcined sample suggests that this material does not possess the well defined hexagonal arrays after calcinations.

In both the as-synthesized and calcined samples, the mainly strong peak with (110) reflection is swung to higher  $d_{110}$  spacing values with increase in temperature of hydrothermal synthesis from 60<sup>0</sup>C to 90<sup>0</sup>C and afterwards it lowers (Fig.1A) and (Fig.1 B).



**Fig.1: XRD patterns of (A) as-synthesized and (B) calcined samples of RHA-SBA-16(60<sup>0</sup>C to 90<sup>0</sup>C) for synthesis temperatures 60<sup>0</sup>-90<sup>0</sup>C**

The sample RHA-SBA-16(80) in its as-synthesized form shows a different XRD pattern as in Fig. 1-A. The higher angle peaks due to (110) and other reflections are likely to fuse together forming one broad peak. This is due to the instability of the sample at the higher temperature, required for the removal of surfactant molecules present between the silicate sheets.

**II) % Crystallinity and Activation Energy:**

The percent crystallinity of the samples drawn at different synthesis temperatures in the crystallization kinetic was obtained by the following relation.

$$\% \text{ Crystallinity} = \frac{\text{Sum of the peak heights of unknown material} \times 100}{\text{Sum of peak heights of standard material}}$$

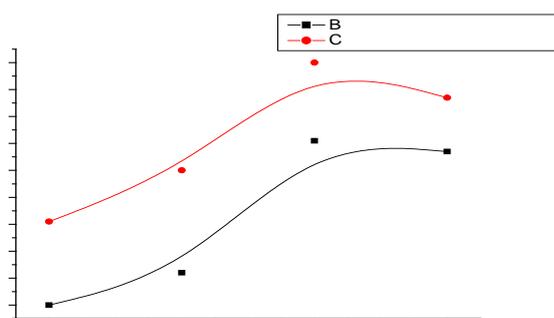


Fig.1: (C) Effect of synthesis temperature on crystallization

The characteristic peaks of RHA-SBA-16 starts appearing after 75<sup>0</sup>C and the fully crystalline phase is obtained around 80<sup>0</sup>C (with  $2\theta \cong 1.14^0, 2.53^0, 3.24^0$  and  $5.20^0$  values). This unusual shorter crystallization temperature may be due to higher reactivity of the source of silica extract derived from RHA. The most crystalline sample in the synthesis system was treated as 100 % crystalline. It is also observed from the powder XRD profiles that obtained characteristic peaks closely match with the reported data.

**Table 1: Effect of crystallization temperature on Structural and textural properties of RHA-SBA-16**

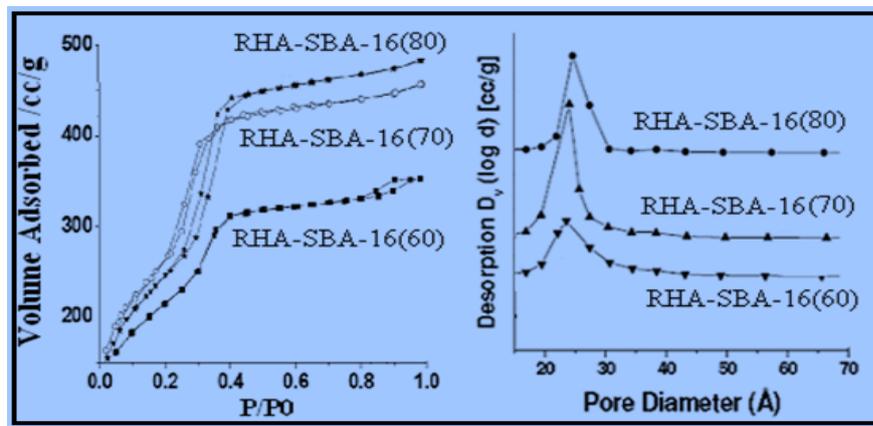
As synthesized Samples	$d_{110}$	Unit cell parameter	S.A. (m <sup>2</sup> /g)	Average pore diameter (Å)	Pore volume (ml/g)	Average wall thickness (Å)	% Crystallinity
RHA-SBA-16(60)	20.13	28.99	217.22	--	-	--	10
RHA-SBA-16(70)	21.51	30.97	326.42	--	-	--	22
RHA-SBA-16(80)	23.44	33.75	701.35	25.32	0.416	8.43	71
RHA-SBA-16(90)	23.12	33.29	606.70	24.91	0.488	8.38	67
<b>For Calcined Samples</b>							
RHA-SBA-16(60)	23.43	33.74	664.34	25.63	0.492	8.11	41
RHA-SBA-16(70)	25.55	36.79	711.65	27.33	0.523	9.46	60
RHA-SBA-16(80)	26.93	38.78	779.70	29.16	0.568	9.62	100
RHA-SBA-16(90)	23.68	34.10	689.21	25.21	0.501	8.89	87

Table 1 summarizes the values of inter planar spacing (d values) derived from X-ray diffraction pattern for RHA-SBA-16 (100 % crystalline) and was used as a parent sample for further study. The kinetic curve describing the increase in the crystallinity of the crystals with the synthesis temperature (before and after calcination) is nearly "S" shaped that depends on rate of conversion. This type of sigmoidal nature of crystallization curve indicates two distinct stages, namely an induction period and a crystal growth period. It is seen from the Fig. 1 (C) that up to 60<sup>0</sup>C the rate of conversion of amorphous to crystallization of RHA-SBA-16 phase was initially slow and then it increased sharply between 70<sup>0</sup>C to 80<sup>0</sup>C followed by subsequent slow down. By the application of Arrhenius equation to the kinetics of crystallization of RHA-SBA-16, apparent activation energy of conversion of aluminosilicate gel to 100% crystalline phase was found to be 106.12kJmole<sup>-1</sup> in the present crystallization system.

### III) BET surface area and pore volume of RHA-SBA-16

The samples synthesized at different temperatures have also been characterized by N<sub>2</sub>-adsorption-desorption study. The isotherms obtained from N<sub>2</sub>-adsorption-desorption and corresponding BJH pore size distribution is shown in Fig. 2(A, B). According to IUPAC classification, these isotherms of RHA-SBA-16 are of type IV, which is the characteristic of mesoporous material. The isotherms exhibit three stages. The first stage is a linear part almost going through the origin, which is due to monolayer adsorption of nitrogen on the walls of the mesoporous ( $p/p_0 < 0.2$ ). The second stage is characterized by a steep increase in adsorption (within the relative pressure  $p/p_0$  range of 0.2-0.4) due to capillary condensation of N<sub>2</sub> in the pore channels. This part shows hysteresis.

The  $p/p_0$  value at which the inflection starts is related to the diameter of the mesoporous. The sharpness in this step indicates the uniformity of the pore size distribution. The third stage in the adsorption isotherm is an almost horizontal part after the relative pressure  $p/p_0$  of ~0.35 and is due to multilayer adsorption on the outer surface of the particles. In addition, a hysteresis loop at relative pressure  $p/p_0 > 0.8$  corresponds to a capillary condensation in the inter particle pores.



(A) (B)

**Fig.2: (A) N<sub>2</sub> adsorption-desorption isotherms and (B) pore size distribution of RHA-SBA-16 (60, 70, 80) synthesized at 60<sup>o</sup>-80<sup>o</sup>C**

For Samples RHA-SBA-16 (60) and RHA-SBA-16 (80), a linear increase in adsorption at low pressures is observed followed by a steep increase in nitrogen uptake [at a relative pressure of  $p/p_0 = 0.31-0.41$  and  $0.25-0.35$  for RHA-SBA-16(60) and RHA-SBA-16(80), respectively due to capillary condensation inside the mesoporous Fig. 2 (A) for RHA-SBA-16(60, 70, 80). The broad hysteresis loop in the isotherm for RHA-SBA-16(60) reflects disorder in the shape and size of the mesoporous. This step of the isotherm is sharper for RHA-SBA-16(80) indicating a narrow pore size distribution. Thus, as the crystallization temperature increases from 60<sup>o</sup>C to 80<sup>o</sup>C, the step of the isotherm becomes sharper indicating narrower pore size distribution Fig. 2 (B) for RHA-SBA-16 (60, 70, and 80)

The N<sub>2</sub>-adsorption-desorption isotherms and the pore size distribution of the Sample RHA-SBA-16 (90) are found that the hysteresis loop is a wide range of relative pressures,  $p/p_0$  (0.28-1.00). The shape of the hysteresis loop confirms the formation of a lamellar phase. The pore size distribution becomes broader.

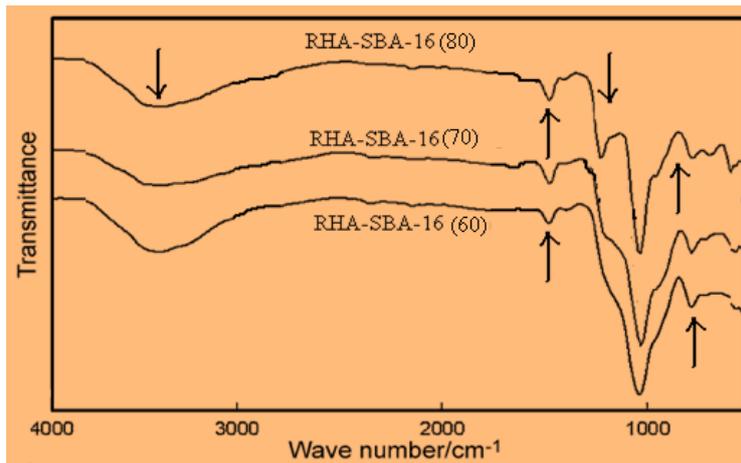
Thus, the XRD results are confirmed by N<sub>2</sub>-adsorption-desorption data, which are similar to those, reported for SBA-16. In pore size distribution curve, narrow and sharp peak is observed in the diameter range 20-25 Å showing uniform pore size. The isotherms of the RHA-SBA-16 samples show small hysteresis loop in the lower pressure regions. We noted that the surface areas of calcined RHA-SBA-16 samples are comparatively more than as synthesized RHA-SBA-16 and it is increasing with the increase in crystallization temperature. The more surface area (788.6m<sup>2</sup>/g) is an indication of well narrow dispersion of pores.

Table 1 presents a summary of all the parameters obtained by nitrogen sorption and powder X-ray diffraction pattern. The unit cell parameter ( $a_0$ ) has been calculated by the formula  $a_0 = \sqrt{2} d_{110}$ . The wall thickness has been calculated by subtracting the pore diameter obtained from N<sub>2</sub>-sorption from the unit cell parameter ( $a_0$ ). It is observed from the tabulated data that spacing value of most intense peak at  $d_{110}$  is slightly increase and the pore diameter is decreased with increase in temperature of hydrothermal synthesis from 60<sup>o</sup>C to 80<sup>o</sup>C. It is due to increase

in the wall thickness of the pores of RHA-SBA-16. The surface area is increased with the increase in synthesis temperature from 60°C to 90°C due to the progressive formation of ordered mesophase silica. However, the surface area decreases with further increase in synthesis temperature due to silica pore shrinkage. This suggests that increasing the synthesis temperature can accelerate the silicate condensation on the silica wall, which subsequently thickens the silica framework.

Thus, the above results indicate that in hydrothermal synthesis of RHA-SBA-16 molecular sieves, temperature plays a significant role. An increase of the crystallization temperature from 60°C to 80°C increases the long-range order in the structure as well as the wall thickness of the RHA-SBA-16 molecular sieves. However, with further increase in the temperature to 90°C, the hexagonal phase changes to a lamellar one under the synthesis conditions.

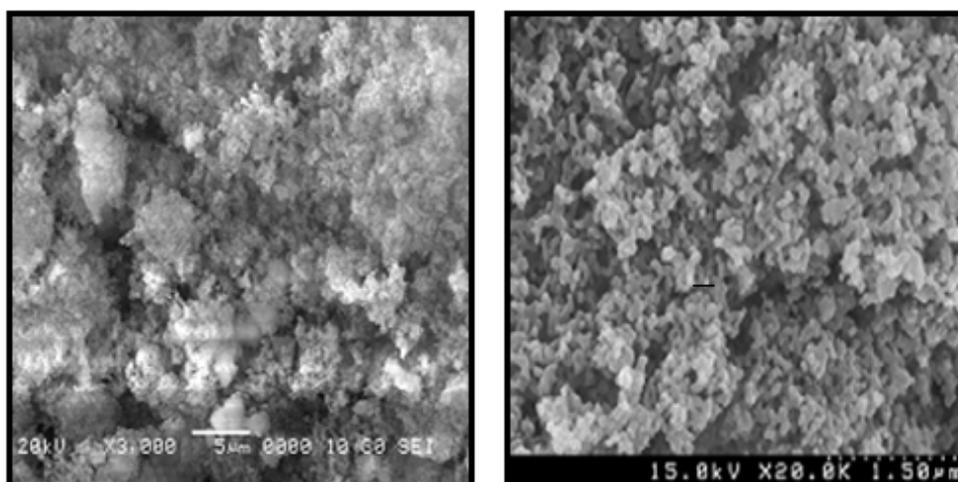
#### IV) FTIR-studies:



**Fig. 3: FTIR spectrum of RHA-SBA-16 (60, 70, 80) Synthesized at 60, 70 and 80°C**

The FTIR spectra of RHA-SBA-16 (60, 70, and 80) after calcination are illustrated in Fig.3. The broad band around 3450 cm⁻¹ is due to surface silanols and adsorbed water molecules which indicate the silica framework is hydrophilic. For calcined RHA-SBA-16, the disappearance of peak at 2879.2 cm⁻¹ and 2842.3 cm⁻¹ can be concluded that the calcination at 550°C is complete. This indicates that the organic template has been removed completely due to calcination. RHA-SBA-16 tends to adsorb water vapors in air since the surface of silica framework is water liking, the stretching mode of H₂O is observed at 1585.6 cm⁻¹. Bands observed at 1154.7 cm⁻¹ and 1084.0 cm⁻¹ are characteristics peaks of asymmetric Si-O-Si stretching. Another characteristics peak is the symmetric Si-O-Si stretching observed at 795.6 cm⁻¹. However, the peak at 2325.2 cm⁻¹ is prominently found to be changed due to the effect of synthesis temperature. The effect observed for RHA-SBA-16(80) is noticeable, which is also supported by the XRD analysis and sorption studies of the samples.

#### V) SEM and TEM-Analysis:

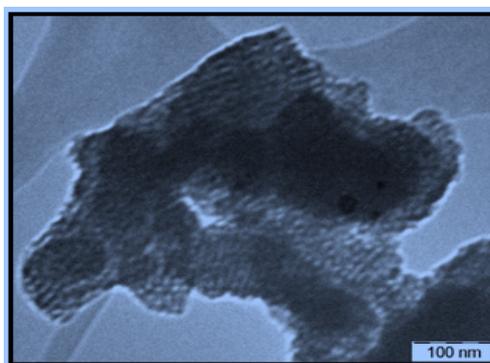


**Fig. 4: SEM images of RHA-SBA-16(60, 80) synthesized at 60 and 80°C**

SEM images of RHA-SBA-16(60, 80) are depicted in Fig.4 represents that the ensuing particles are roughly spherical in shape with no agglomerations. Small spherical particles are of RHA-SBA-16(80) with diameters of 7.6 to 18.4Å.

It is observed that the average diameter of the particles is slightly increased as the synthesis temperature is elevated from 60°C to 90°C after calcination. However when the synthesis temperature was around 80°C, the prepared sample has signified a high-quality structural morphology.

**TEM-Analysis:**



**Fig. 5: TEM images of RHA-SBA-16(80) synthesized at 80°C**

Fig. 5 represents the TEM images of RHA-SBA-16 synthesized at 80°C. TEM image of the parent RHA-SBA-16 samples provided strong confirmation of the retainment of mesoporous structure of the supports. The characteristic hexagonal silicate structures shown on TEM, supports the observation made by low angle XRD.

**CONCLUSION:**

The correlation of the work reported by (Carniato Fabio *et al* 2012) is using commercially available chemicals but our research is by using low cost waste material. We got the same result as reported.

All the characterization techniques performed in this study reveals that well ordered mesoporous material of uniform hexagonal array can be synthesized very conveniently and in a very short span of time from an agro waste rice husk ash instead of commercial expensive silica sources. The parametric variation such as change of synthesis temperature helps to optimize the synthesis conditions. The well ordered mesoporous material RHA-SBA-16 can be synthesized at 80°C for 4.5h keeping pH of gel 6.9 and calcined at 550°C. The apparent activation energy of conversion of synthesis gel to 100 % crystalline RHA-SBA-16 phase was 184.62kJ/mole calculated by Arrhenius equation.

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# Seasonal Effects of Water Quality Changes in Neyyar River, Kerala, India

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**Abstract-** The seasonal fluctuations in various physico-chemical parameters in the water were investigated in the six sampling sites namely Neyyar Dam, Kallikkadu, Mandapathinkadavu, Aruvippuram, Neyyattinkara and Poovar of Neyyar River on the basis of their physiographic distribution during north east monsoon and pre-monsoon. Water temperature broadly fluctuated between 27.0°C at Neyyar dam in north east monsoon to 33.2°C at Neyyattinkara in pre-monsoon. Though, seasonal influence was marginal, a lowering in pH was generally visible during north east monsoon. In the station near coast, impact of saline intrusion was obvious in the distribution of EC. TDS varied broadly between 20.4mg/l to 16000mg/l, respectively in the reservoir and the Poovar. Correspondingly the chloride also has been gradually increasing towards downstream. In general turbidity is found to be low except occasional high values at Kallikkadu. Our study indicates that alkalinity values are very less all along the river during both seasons and total hardness exceeds the prescribed limits in downstream stretches. The samples in the midland and lowland invariably showed considerable concentrations of the nutrient. Inverse to the distribution of DO, the BOD value was the minimum at reservoir and the maximum at Poovar. Significant correlations between the parameters were observed by using SPSS software.

**Index Terms-** Neyyar, North east monsoon, Physico-chemical parameters, Physiography, Pre-monsoon.

## I. INTRODUCTION

Rivers play an important role in human progress by providing drinking water, making the earth fertile and serving as a medium for transport. The ecosystem services provided by rivers have been utilized by humans without knowing the functions and vitality of river (Naiman, 1992). The nature of many of the rivers around the world are changed due to unscientific construction of bunds across the river, reclamation of water holding and purifying regions, overexploitation of their living and non-living resources and disposal of various waste materials directly in to the river. Indian river system is polluted mainly because of the human impact (Goel *et al.*, 2001, Patil *et al.*, 2003 and Maity *et al.*, 2004) and major rivers are grossly polluted, especially beside the cities (Srivastava, 1992). The river water quality has been greatly influenced not only by such activities but natural and climatic determinants may also contribute. Pollution of river with the seasonal change in water quality is of great environmental concern worldwide.

The Neyyar River is one of the important small catchment rivers in the south-western coast of India, originates from

Agasthya malai in the Western Ghat mountain ranges at an elevation of about 1866m above mean sea level. This small river flows through highly varied geologic and physiographic provinces of the area for a length of about 56km. Though, this river ecosystem face severe pollution threats because of the huge disposal of various waste materials, sand mining and agricultural practices at its bank, it is extensively used for domestic, recreational, drinking and irrigation purposes in the area. The water related issues are very critical in the small catchment rivers of developing economies with high incidence of human stress (Padmalal *et al.*, 2011). The water quality of a riverine ecosystem can be assessed mostly by studying its physico-chemical characteristics. The seasonal change in surface water quality is an important aspect for evaluating temporal variations of river pollution (Ouyang *et al.*, 2006). Under this context, the present study tries to focus on the water quality changes along the course of Neyyar River from the upstream stretch to the downstream during pre-monsoon and north east monsoon.

## II. MATERIALS AND METHODS

Neyyar is the southern-most river of Kerala State having a total basin area of 483sq. km, lies between 8°15' to 8°40'-N latitudes and 77°00' to 77°20'-E longitudes (Fig. 1). The river's main tributaries are Chittar, Aruvikod thodu and Maruthur thodu. Six sites located along the upstream to downstream course of the river were sampled. The sampling sites such as Neyyar Dam (S1), Kallikkadu (S2), Mandapathinkadavu (S3), Aruvippuram (S4), Neyyattinkara (S5) and Poovar (S6) are fixed along the river considering the physiography (Table 1). The sampling locations at Neyyar dam and Kallikkadu are situated at the highland physiographic area, whereas Mandapathinkadavu station is located at the transition area of highland and midland, Aruvippuram at the midland and Neyyattinkara and Poovar at the lowland.

Water samples were collected from six sampling stations of the river monthly for two seasons namely Northeast monsoon (October to November-2015) and Pre-monsoon (March to April-2016). Water sample is analyzed for physico-chemical parameters such as Water temperature (WT), PH, Electrical Conductivity (EC), TDS, Turbidity (Turb.), Chloride (Cl), Total Alkalinity (T.Alk), Total Hardness (T.H), Nitrate (NO<sub>3</sub>-N), Phosphate (PO<sub>4</sub>), Sulphate (SO<sub>4</sub>), DO and BOD. In-situ determination is done for parameters such as Water temperature, pH and alkalinity and samples of DO and BOD is chemically fixed in the field itself. All the analyses are carried out following standard methods (APHA, 2005). Seasonal average and standard deviation of data on water quality were calculated using

Microsoft Excel. The significance of the result was statistically verified by correlation coefficient analysis using SPSS package 16.00 and also significant difference in the value of each

parameter between sampling stations and between seasons was plotted graphically with the help of MS Excel.

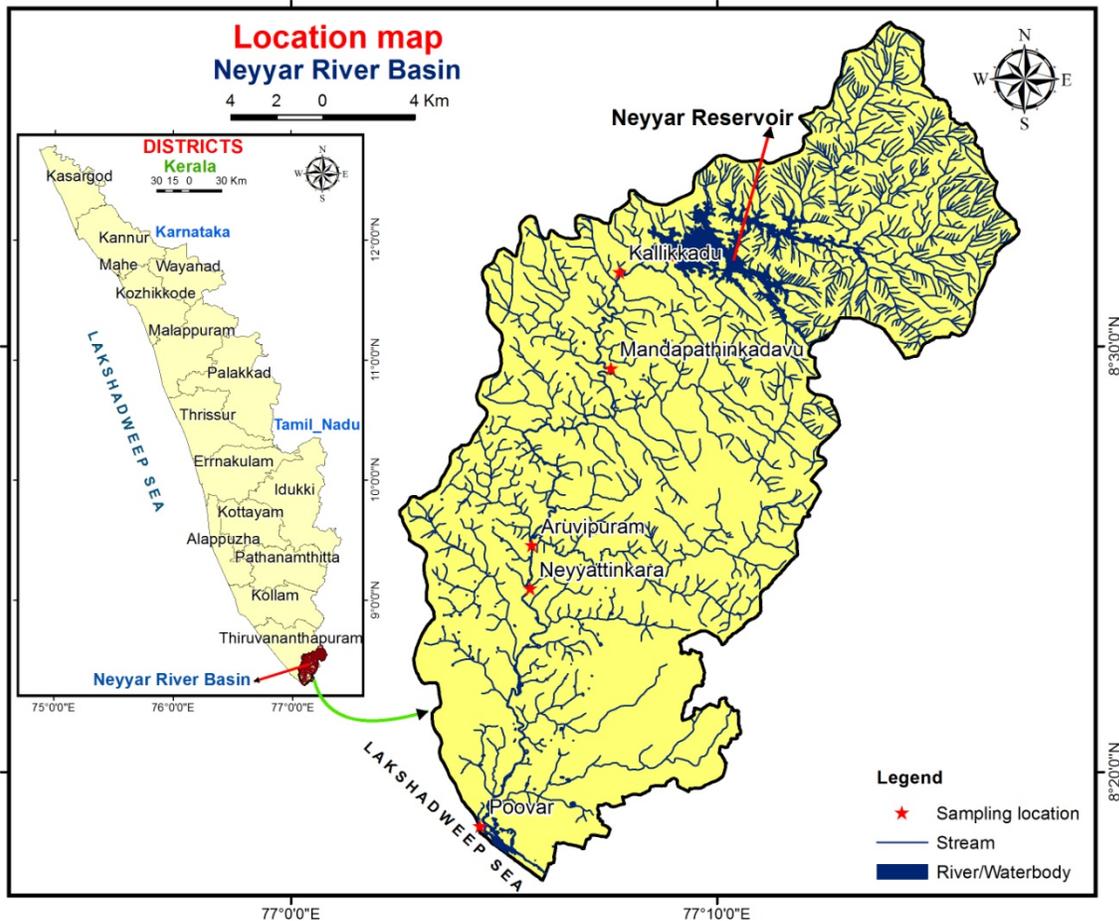


Fig 1: Water sampling locations in Neyyar River

Table 1: Land use characteristics in the Neyyar River basin

Location	Latitude & Longitude	General Physiography	Land use pattern
Neyyar Dam (S1)	N08°32'6.3" E77°08'44.0"	Highland	Reserve forest
Kallikkadu (S2)	N08°31'46.4" E77°07'39.4"	Highland	Rubber and Mixed crops
Mandapathinkadavu (S3)	N08°29'27.9" E77°07'27.6"	Transition area	Settlement with mixed crops
Aruvippuram (S4)	N08°25'16.0" E77°05'34.1"	Midland	Mixed crops and settlement with mixed tree crops
Neyyattinkara (S5)	N08°24'9.6" E77°05'19.6"	Lowland	Settlement with mixed tree crops, Municipal region
Poovar (S6)	N08°18'30.5" E77°04'36.9"	Lowland	Coconut with mixed tree crops, Coastal area

III. RESULTS AND DISCUSSION

The seasonal variations in the water quality parameters of the six sampling sites have summarized in Table-2 and Table-

3 and correlation between the parameters is shown in Table-4 and Table-5.

Table 2: Physico-chemical parameters of Neyyar River

Parameter	Pre-monsoon						North east monsoon						BIS
	S1	S2	S3	S4	S5	S6	S1	S2	S3	S4	S5	S6	
WT(°C)	30.75	31	32.25	32.25	33.25	32.25	27	28	29	29.5	30	29	.....
PH	6.95	7.1	7.15	7.15	7.3	8.15	6.62	6.75	6.97	6.75	6.9	7.75	6.5-8.5
EC(µS/cm)	35	54.5	63.0	60.5	68.0	26410	29.5	43.0	47.5	52.0	50.2	19682.5	1500
TDS(mg/l)	24.5	34.8	37.35	38.45	41.7	16000	20.4	29.35	27.6	32.52	32.5	12355	500
Turbidity(NTU)	0.5	1	1	0.5	1	2	1	2	1.5	1.5	2.5	6.25	1
Chloride(mg/l)	7.3	9.5	15.4	15.35	24.65	16938	4.6	7.7	9.9	10.1	12.8	3614	250
Alkalinity(mg/l)	21	24.5	24.5	27	35	75.5	12.5	17	16.5	20	27.5	50	120
Hardness(mg/l)	11.1	14.6	15.6	15.4	18.3	594	7.3	12.6	10.5	12.1	14.7	472.2	300
Nitrate(mg/l)	0.24	0.33	0.36	0.33	1.36	2.39	0.41	0.46	0.52	0.49	2.41	3.96	45
Phosphate(mg/l)	0.039	0.06	0.045	0.05	0.06	0.07	0.045	0.075	0.055	0.075	0.105	0.175	0.1
Sulphate(mg/l)	0.26	0.34	0.39	0.39	3.08	1462	ND	0.11	0.13	0.12	0.98	664.5	200
DO(mg/l)	5.76	4.72	5.07	5.71	4.52	3.99	6.66	5.07	5.86	6.49	4.79	4.13	5
BOD(mg/l)	0.36	2.58	1.97	2.11	2.59	3.27	0.19	1.03	0.78	0.59	2.26	2.94	<3

Table 3: Range and SD of various water quality parameters

Pre-monsoon													
	WT	pH	Cond.	Turb.	TDS	Cl	T.Alk	T.H	SO4	NO3	PO4	DO	BOD
Min	30.75	6.95	35.0	0.5	24.5	7.3	21	11.1	0.26	0.24	0.039	3.99	0.36
Max	33.25	8.15	26410.0	2	16000	16938	75.5	594	1462	2.39	0.07	5.76	3.27
Range	30.75-33.25	6.95-8.15	35-26410	0.5-2	24.5-16000	7.3-16938	21-75.5	11.1-594	0.26-1462	0.24-2.39	0.039-0.07	3.99-5.76	0.36-3.27
Average	31.96	7.3	4448.50	1	2696.13	2835.033	34.58	111.50	244.41	0.84	0.05	4.96	2.15
SD	0.93	0.43	10758.90	0.55	6517.54	6909.02	20.59	236.39	596.50	0.87	0.01	0.69	0.99
North east monsoon													
	WT	pH	Cond.	Turb.	TDS	Cl	T.Alk	T.H	SO4	NO3	PO4	DO	BOD
Min	27	6.62	29.5	1	20.4	4.6	12.5	7.3	0	0.41	0.045	4.13	0.19
Max	30	7.75	19682.5	6.25	12355	3614	50	472.2	664.5	3.96	0.175	6.66	2.94
Range	27-30	6.62-7.75	29.5-19682.5	1-6.25	20.4-12355	6.5-14680	12.5-50	7.3-472.2	0-664.5	0.41-3.96	0.045-0.175	4.13-6.66	0.19-2.94
Average	28.75	6.96	3317.45	2.458	2082.90	609.85	23.92	88.23	110.97	1.38	0.09	5.5	1.30
SD	1.08	0.41	8017.21	1.93	5032.29	1471.729	13.72	188.12	271.17	1.49	0.05	1.00	1.07

Rainfall indicates astonishingly higher north east monsoon than the south west monsoon (Fig -2), which has been observed in the southern districts of Kerala during the last 2-3 years. Such a shift in the rainfall pattern may have tremendous influence on the water availability and cropping pattern which needs to be investigated. Water temperature broadly fluctuated between 27.0°C at Neyyar dam in north east monsoon to 33.2°C at Neyyattinkara in pre-monsoon (Fig-3). The study indicates that the fluctuation in water temperature has a relative influence of rainfall.

The pH in general varied between 6.6 and 8.15, the minimum value at the reservoir during north east monsoon and the maximum at Poovar in pre-monsoon. Though, seasonal influence was marginal, a lowering in pH was generally visible during north east monsoon (Fig-4). The pH is of near neutral to alkaline range suggesting well buffered river waters. Similar pH

ranges were also recorded by Gautam *et al.*, (2000) in river Ganga at Rishikesh and Verma (2006) in river Narmada.

Electrical conductivity in general varied between 29.5µmhos/cm at reservoir during north east monsoon (Fig-5) and 26410µmhos/cm at Poovar in pre-monsoon (Fig-6). Electrical conductivity of water also shows a marginal influence of rain. In the station near coast, impact of saline intrusion was visible. Its increase towards downstream could be due to the urban and agriculture drainage. The various ions added to the water from catchment areas regulate the conductivity of the water.

TDS follows the trend of EC in all seasons, as TDS is directly proportional to EC. TDS varied broadly between 20.4mg/l to 16000mg/l, respectively in the reservoir during north east monsoon and the Poovar in pre-monsoon (Fig-7 and Fig-8).

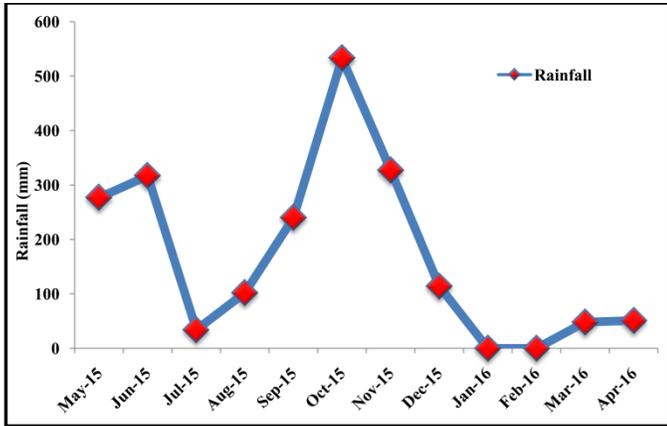


Fig 2: Monthly variations of rainfall at Amaravila gauging station of Neyyar river basin (Indian Meteorological Department (IMD) data)

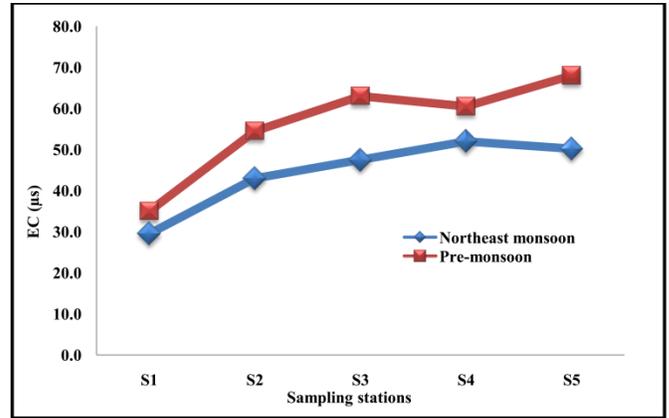


Fig 5: Seasonal distribution of Electrical conductivity in Neyyar river water

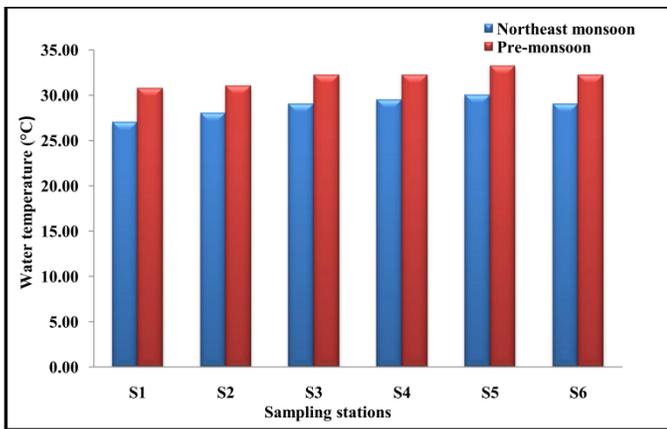


Fig 3: Seasonal distribution of Water temperature in Neyyar river

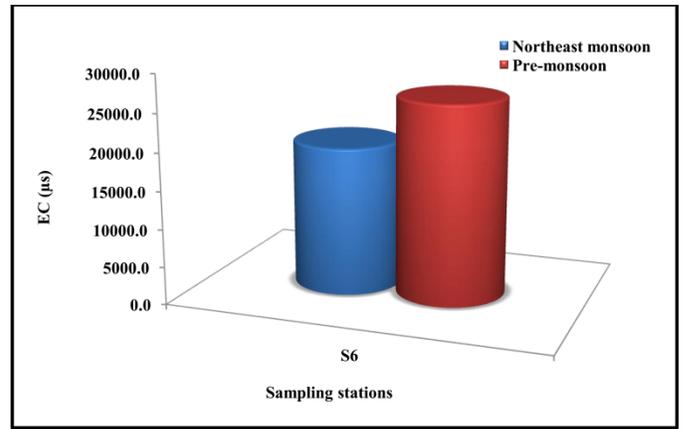


Fig 6: Seasonal distribution of Electrical conductivity at Poovar river

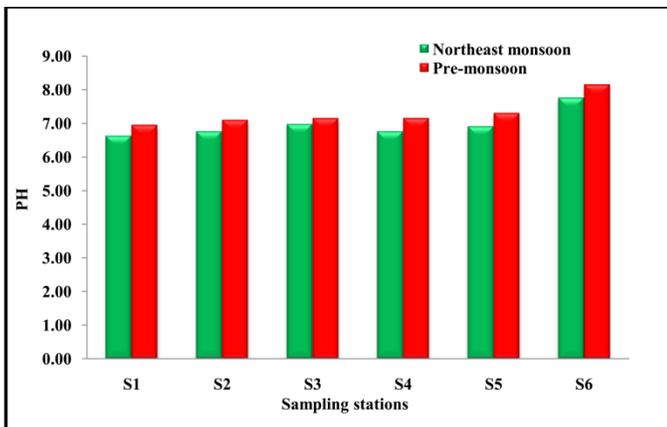


Fig 4: Seasonal distribution of Hydrogen ion concentration in Neyyar river water

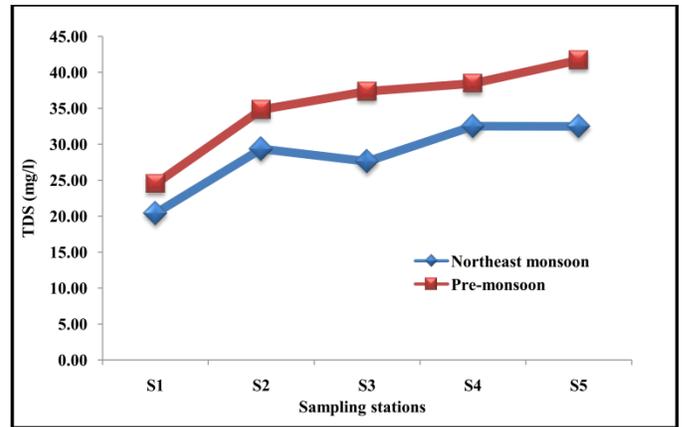


Fig 7: Seasonal distribution of TDS in Neyyar river water

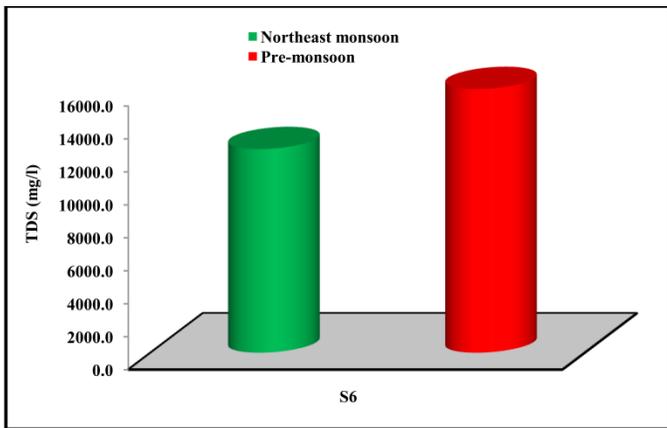


Fig 8: Seasonal distribution of TDS at Poovar

In general, turbidity found to be low at reservoir and high at Poovar except occasional high values in Kallikkadu station, where the water is stagnant due to extensive sand mining taken place in the past. It is varied broadly between 0.5NTU in pre-monsoon and 6.25NTU in north east monsoon (Fig-9).

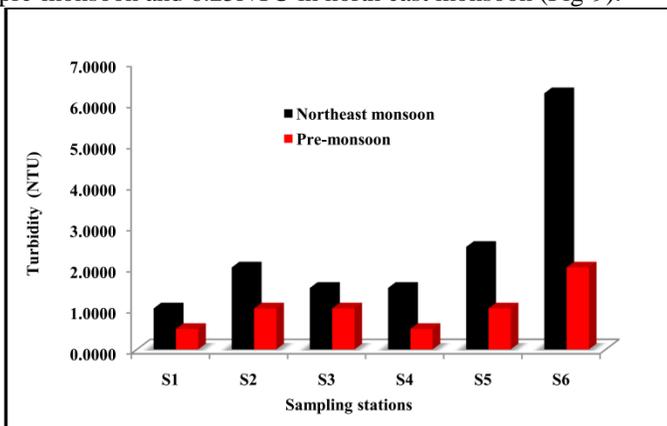


Fig 9: Seasonal distribution of Turbidity in Neyyar river water

Alkalinity is important in determining the ability of a stream to neutralize acidic pollution from rainfall or wastewater. Present study indicates that alkalinity values are very less all along the river during all the seasons. All samples show alkalinity values below the range prescribed by BIS (2004) for drinking purpose (Fig-10).

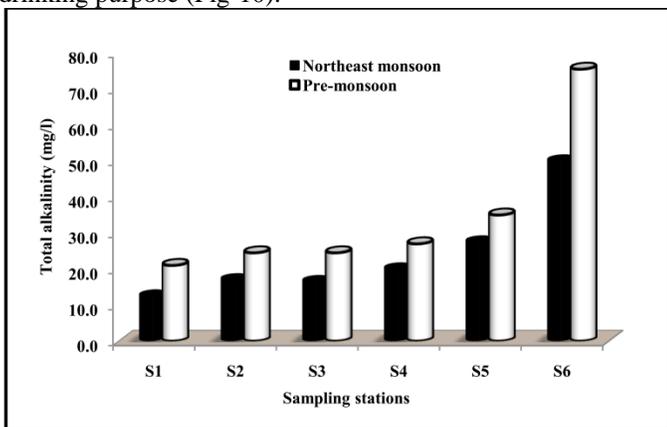


Fig 10: Seasonal distribution of Alkalinity in Neyyar river water

The gradual increase in chloride concentration down the river could be due to the increase in urban land use and due to the addition of some industrial discharge (Allan, 1996). The

concentration of chlorides increases with the degree of eutrophication and such a scenario is visible from the study area (Fig-11 and Fig-12).

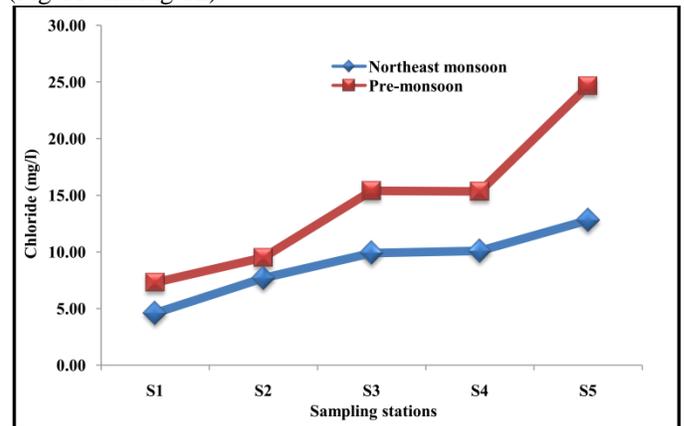


Fig 11: Seasonal distribution of Chloride in Neyyar river water

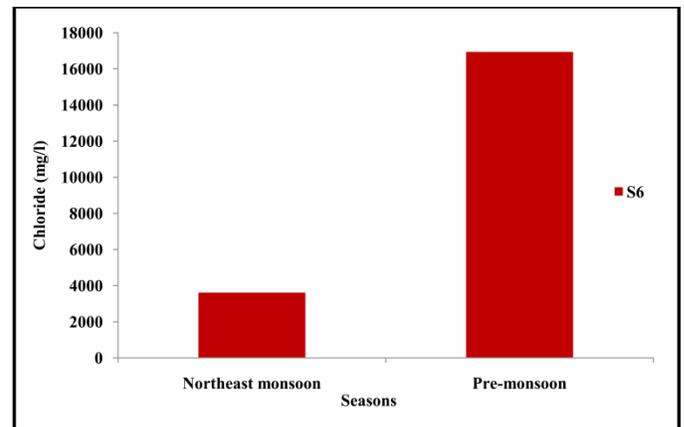


Fig 12: Seasonal distribution of Chloride at Poovar

Hardness is governed by the contents of calcium and magnesium salts largely combined with bicarbonates and carbonates giving temporary hardness and with sulphates, chlorides causing permanent hardness. The optimum values of hardness range between 75 to 150 mg/l, supports fish productivity (Basant Kumar, 2011). The hardness values in the present study are beyond the limits for drinking water for downstream stations (Fig-13 and Fig-14). Though, nitrate was negligible in all seasons in the upstream stations, samples in the mid and lowland invariably show considerable concentrations of the nutrient. High values of nitrate during rainy season can be due to influx of nitrogen rich flood water that brings large amount of contaminated sewage water (Fig-15).

Phosphate values were comparatively high at Poovar possibly due to the continuous contact of seawater (Fig-16). High phosphate values at the range of 1.60-5.26mg/l were reported in Thenpennaiyar River, Tamilnadu by Sridhar and Senthil Kumar (2016) who also reported high phosphate in monsoon period like that observed in the present study. The phosphate concentration between 0.002 and 0.399 mg/l in different site areas was reported from Pennar River (Joseph and Jacob, 2010). The concentration of sulphate was found to be very low up to Aruvippuram, from where it increased maximum at Poovar, which is very close to the sea (Fig-17 and Fig 18).

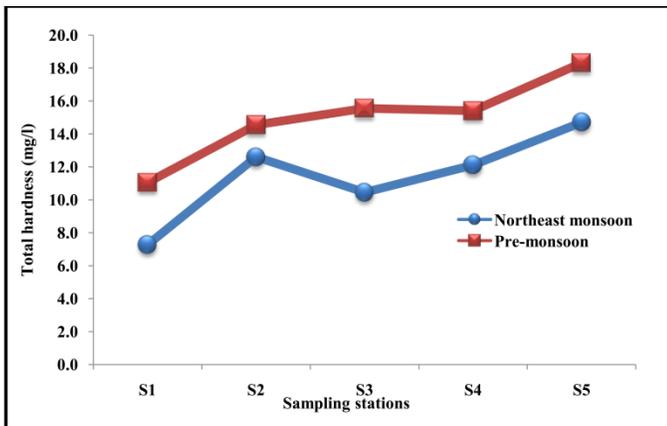


Fig 13: Seasonal distribution of Total hardness in Neyyar river water

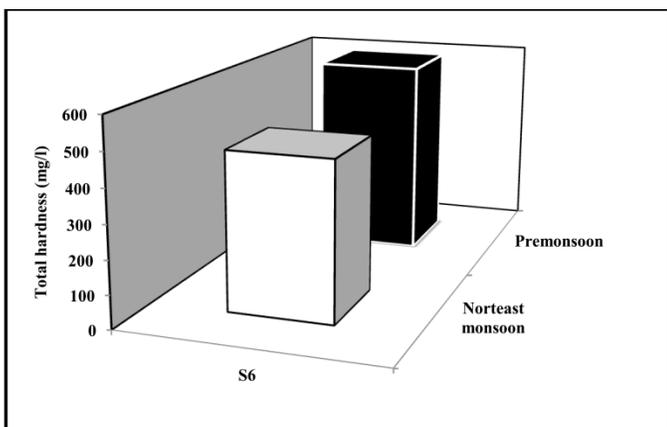


Fig 14: Seasonal distribution of Total hardness at Poovar

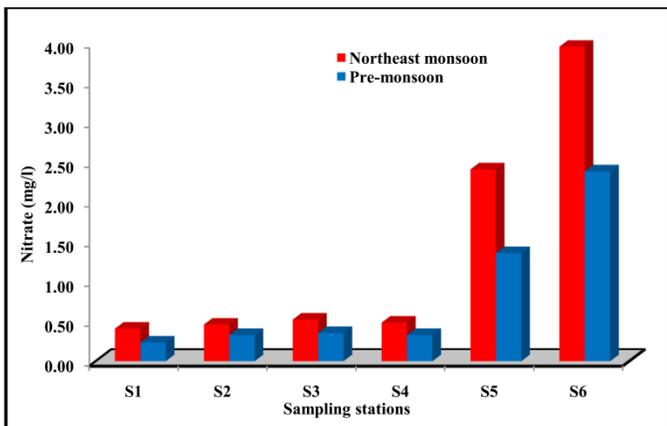


Fig 15: Seasonal distribution of Nitrate in Neyyar river water

The DO values ranged from 3.9mg/l during pre-monsoon at Poovar to 6.1mg/l during north east monsoon at reservoir station (Fig 19). The higher concentration of DO during winter can be attributed to the fact that cold water contains more oxygen as compared to warm water as the DO is inversely proportional to the water temperature (Hynes, 1988). In addition photosynthesis could have some kind of effect on DO.

Inverse to the distribution of DO, the BOD values fluctuates between the lowest in reservoir to the highest in Poovar (Fig.20). The BOD values are obtained maximum in pre-monsoon at all sampling stations, which may be due to high

temperature, this in turn promotes microbial activities and minimum BOD values obtained may be due to low temperature and sufficient amount of water in the river. Similar observations were confirmed by many other workers such as Pathak and Mudgal (2005). The biological oxygen demand seems to be high during premonsoon probably due to stagnation of contaminants which shows the degradation of the river system from the highland portion onwards

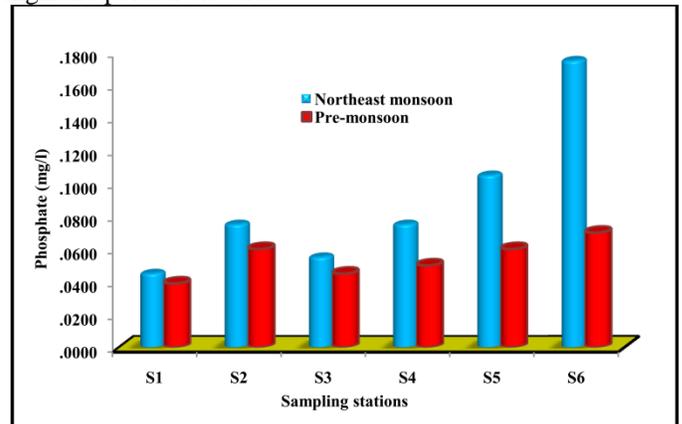


Fig 16: Seasonal distribution of Phosphate in Neyyar river water

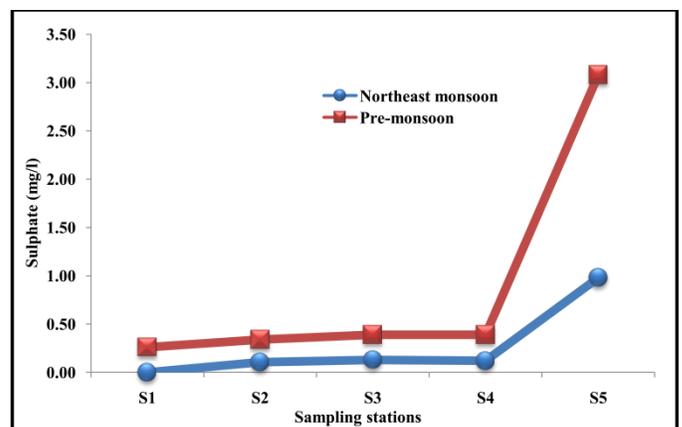


Fig 17: Seasonal distribution of Sulphate in Neyyar river water

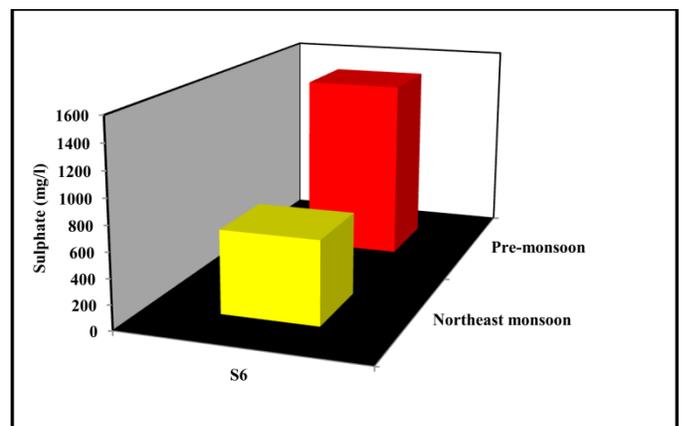


Fig 18: Seasonal distribution of Sulphate at Poovar

Correlation coefficient analysis of the water quality parameters demonstrates clearly the type and degree of relationship among them. In north-east monsoon, water temperature showed moderately significant positive correlation

with PH, alkalinity, nitrate, phosphate and BOD and negative correlation with DO. The PH, conductivity, turbidity, TDS, chloride, alkalinity, total hardness, sulphate, nitrate and phosphate showed highly significant positive correlation with all parameters except DO. Dissolved oxygen showed significant negative correlation with all parameters. BOD showed significant positive correlation with all parameters except DO.

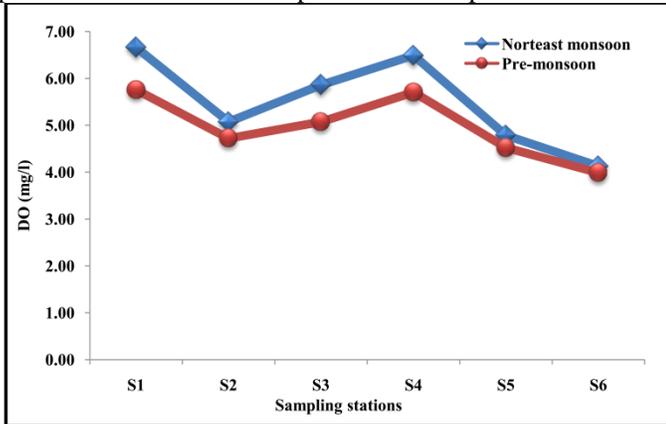


Fig 19: Seasonal distribution of DO in Neyyar river water

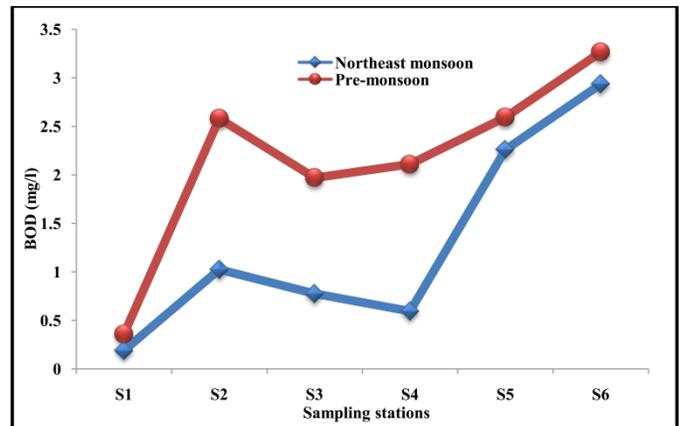


Fig 20: Seasonal distribution of BOD in Neyyar river water.

But in pre-monsoon DO showed marginal increase in negative correlation values with all parameters except BOD. Inverse to DO, BOD in pre-monsoon showed marginal decrease in positive correlation values with PH, conductivity, turbidity, TDS, chloride, total alkalinity, total hardness, sulphate, nitrate and phosphate and negative correlation values with BOD except water temperature.

Table 4: Correlation coefficient analysis of various water quality parameters during Northeast monsoon

	WT	pH	Cond.	Turb.	TDS	Cl	T.Alk	T.H	SO4	NO3-N	PO4	DO	BOD
WT	1												
pH	0.326	1											
Cond.	0.144	0.953**	1										
Turb.	0.281	0.961**	0.964**	1									
TDS	0.114	0.953**	1.000**	0.965**	1								
Cl	0.115	0.953**	1.000**	0.965**	1.000**	1							
T.Alk	0.422	0.946**	0.931**	0.981**	0.931**	0.932**	1						
T.H	0.123	0.955**	1.000**	0.968**	0.999**	0.999**	0.935**	1					
SO4	0.114	0.953**	1.000**	0.965**	1.000**	0.999**	0.932**	0.999**	1				
NO3	0.427	0.884*	0.853*	0.932**	0.853*	0.853*	0.964**	0.857*	0.853*	1			
PO4	0.430	0.909*	0.900*	0.975**	0.900*	0.900*	0.990**	0.905*	0.900*	0.957**	1		
DO	-0.388	-0.758	-0.670	-0.830*	-0.670	-0.671	-0.801*	-0.677	-0.670	-0.831*	-0.847*	1	
BOD	0.535	0.835*	0.754	0.893*	0.754	0.755	0.921**	0.761	0.755	0.962**	0.940**	-0.934**	1

\* Correlation is significant at the 0.05 level (2-tailed)  
\*\* Correlation is significant at the 0.01 level (2-tailed)

Table 5: Correlation coefficient analysis of various water quality parameters during pre-monsoon

	WT	pH	Cond.	Turb.	TDS	Cl	T.Alk	T.H	SO4	NO3	PO4	DO	BOD
WT	1												
pH	0.387	1											
Cond.	0.155	0.966**	1										
Turb.	0.295	0.931**	0.895*	1									
TDS	0.155	0.966**	1.000**	0.895*	1								
Cl	0.155	0.966**	1.000**	0.895*	1.000**	1							
T.Alk	0.349	0.996**	0.974**	0.913**	0.974**	0.974**	1						
T.H	0.163	0.968**	0.999**	0.897*	0.999**	0.999**	0.976**	1					
SO4	0.155	0.966**	0.999**	0.895*	0.999**	0.999**	0.974**	0.999**	1				
NO3	0.508	0.948**	0.876*	0.884*	0.876*	0.876*	0.956**	0.879*	0.877*	1			
PO4	0.397	0.797	0.688	0.817*	0.688	0.688	0.785	0.693	0.688	0.811*	1		
DO	-0.416	-0.792	-0.687	-0.918**	-0.687	-0.686	-0.772	-0.691	-0.687	-0.837*	-0.899*	1	
BOD	0.564	0.717	0.558	0.752	0.558	0.558	0.670	0.565	0.558	0.682	0.920**	-0.836*	1

\* Correlation is significant at the 0.05 level (2-tailed)  
\*\* Correlation is significant at the 0.01 level (2-tailed)

#### IV. SUMMARY AND CONCLUSIONS

The present study on the physico-chemical quality of river water reveals that the total alkalinity and nitrate values are within the water quality standards prescribed by BIS and the concentration of all other parameters especially in downstream stations are above the limit set by BIS. From this study it is revealed that degradation of water quality is very high at the downstream stretches of the river. This is due to high anthropogenic disturbances associated with the region and the cumulative effect of all pollutants from upstream. Wild use of chemical fertilizers and pesticides, devious dumping of domestic wastes are also the major causes of rapid fall in water quality. The quality of water is depleting also with the change in climate and other natural processes. Under this context, it is discovered that surface water pollution is comparatively high in pre-monsoon season. Apart from the lowering of water quality, these factors may adversely impact biodiversity of the riverine ecosystem. So this study indicates the need for control measures for a broader perspective to regulate these problems in Neyyar River.

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# Analysis of Variance (ANOVA) for Medically Certified Causes of Deaths/ICD-10 in Delhi during the year 2005-2014

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**Abstract-** This paper is based on final CRS data for the year 2005-2014 on the 10 leading Medically Certified Causes of Death (MCCD)/International Causes of Death-10 in the Delhi (India) by age, sex, race. The Leading causes of infant, neonatal, and post-neonatal death are not analyzed in this paper. The major objective of paper is “To check the variability of causes of death by ten major diseases over the time period of ten years among the age group of specified causes of death. The overall research work of this paper is fully based on most powerful statistical concept i.e. Analysis of Variance (ANOVA) for better output of CRS data of Certified Leading causes of death.

**Methods**—Data in this paper are based on information of death events recorded in concerned Hospitals/Registration Centers of five local bodies of NCT of Delhi by Civil Registration System, (SRS) in last ten years i.e. 2005-2014. ICD-10 is the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD), a medical classification list by the World Health Organization (WHO). The 10 leading Medically Certified Causes of Death diseases has been considered on the basis of Causes of death classified as ICD-10 according to the number of deaths occurred due to concerned diseases. Cause-of-death statistics are based on the underlying cause of death with exploring the relationship among variation of occurrence on particular diseases over a time period and classified age group for the year 2005-2014 is the one of the approaches of this paper. We have performed analysis of variance (ANOVA) to establish the relationship between years and diseases for checking the exact variation of occurrences of diseases over the years. Also, we have done that for Disease wise analysis with respect of Age Group over the Years. We have also used the independent t-test to understand whether our 10 major diseases (individually) differ based on gender for our period of study 2005-2014 with the help of SPSS-22.0.

**Results**—In the year 2005-2014, the 10 leading Medically Certified Causes of Death were considered as: 1-Tuberculosis (A15-A19); 2-Endocrine, nutritional & metabolic diseases (E00-E89); 3-Bacterial diseases (A20-A49); 4-Infectious & Parasitic diseases (A00-B99); 5-Neoplasms (C00-D48); 6- Nervous system disorders (G00-G98); 7-Circulatory system diseases (I00-I99); 8-Respiratory system diseases (J00-J98); 9-Digestive system diseases (K00-K92); 10-Accidents & consequences of external causes (V01-Y89) which is assigned as numeric digit with corresponding MCCD as per ICD-10. These 10 causes accounted at around 65% of all deaths occurred in the NCT of Delhi during 2005-2014. The conclusion drawn from investigating the major death causing diseases in Delhi Region from reveals that:-Infectious & Parasitic diseases, Circulatory system diseases, neoplasms, Respiratory system diseases, bacterial diseases and accidental death cases claimed more lives. It can be concluded that the cause-specific death ratios based on the objective of study indicated that among the leading causes of death Infectious & Parasitic diseases, Circulatory system diseases, and Bacterial diseases and accidents were the most common. It is necessary to point out that Infectious & Parasitic diseases, bacterial diseases and accidental deaths demonstrated an upward trend while that of circulatory system diseases exhibited a pattern of downward trend.

**Keywords:** Medically Certified Causes of Death (MCCD) / ICD-10; leading causes of death ; vital statistics ; CRS; **Hypothesis** ; ANOVA; independent t-test and SPSS.

**INTRODUCTION**

As we are aware that the coding of the Medically Certified Cause of Death(MCCD) is fully based on **ICD-10** with the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD), a medical classification list by the World Health Organization (WHO). It contains codes for diseases, signs and symptoms, abnormal findings, complaints, social circumstances, and external causes of injury or diseases. The code set allows more than 14,400 different codes and permits the tracking of many new diagnoses. The codes can be expanded to over 16,000 codes by using optional sub-classifications. The major work of this paper is the statistical analysis of occurrences of medically certified death events received from all the local bodies of Delhi under the scheme CRS (Civil Registration System) in Delhi during last ten years i.e. 2005-2014. As we aware that , in Delhi, the Chief Registrar (Birth & Death) is responsible for monitoring the registration of Birth & Death with the help of five local bodies/Delhi Municipal Corporation(DMC) i.e. North DMC, South DMC, East DMC, New Delhi Municipal Council & DCB in Delhi. The office of Registrar General of India (ORGI) , Ministry of Home Affairs ,Govt of India is the Nodal Agency to monitor all type of functioning of registration of Birth & Death all over the India and provide the time to time guidelines to Chief Registrars (Birth & Death) of State Government and UT's. There are total twenty major classification of MCCD/ICD-10 coding available in Annual Report/MCCD Report (Birth & Death) of Delhi in each year. But have only taken under consideration of major ten diseases among these twenty who having maximum contribution of causes of death during the entire years. We want to establish the exact relationship among the variation of occurrence of particular diseases over a certain time period and classified age group for the year 2005-2014.

**Source of data:** The complete CRS data of MCCD with entire description of age groups for all major diseases for the ten years (2005-2014) has been collected from website of Directorate of Economics & Statistics, GNCT of Delhi which is also working as Office of Chief Registrar (Birth & Death) of Delhi. This data was collected from the all the local bodies of Delhi (i.e. North DMC, South DMC, East DMC, NDMC & DCB) over that particular year. The entire zonal offices of local bodies are directly engaged with public for collecting the data of birth/death event occurred either in institution or in domicile on the basis of information provided by the informant /uses/public. We have filtered out the major 10 diseases causing the highest no. of deaths during the time period 2005-2014. These major 10 diseases and their corresponding death over the ten years are given below in T1.

YEARS	MAJOR 10 DISEASES FOR THE TIME PERIOD 2005-2014(T1)									
	1	2	3	4	5	6	7	8	9	10
2005	3279	1156	7067	11302	1565	1726	6448	2769	1598	1339
2006	3064	5166	4235	8365	1471	1656	6848	2316	1471	2025
2007	2018	3874	5923	9099	1911	1642	13476	2465	1604	941
2008	2139	4001	5297	8513	2204	1426	12949	2696	1750	1030
2009	2251	4598	5590	9171	3227	1676	13904	3115	1902	1002
2010	3065	1401	5002	15879	5436	961	8215	3746	2116	2456
2011	3603	1707	5699	10652	9266	905	8435	3942	2686	4715
2012	3118	1784	5348	9984	5772	1202	9420	4215	3197	4724
2013	3239	2171	5940	10929	4109	1360	9617	4655	2814	5098
2014	4350	2002	6970	12529	5479	1208	9455	5282	3542	7119

For analysing these 10 major diseases ( total deaths caused by them) with respect to the given time period of ten years 2005-2014, we have conducted an ANOVA test with the above data (Table no. 1). Where numerical number assigned as corresponding diseases as mentioned in introduction part. For analysing these 10 major diseases (total deaths caused by them) with respect to the given time period of ten years 2005-2014, we have conducted an ANOVA test with the above data (Table no. 1). Their results & interpretation have been also discussed in this paper for better understanding. For analysing these 10 major diseases (individually) with respect to the total deaths caused by them in specified age groups in 10 years, we have again conducted ANOVA tests with the following data in T2-T11.

**Total deaths in given age groups due to Tuberculosis from 2005-2014**

T2	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
2005	33	204	223	466	572	568	515	355	111	193

<b>2006</b>	141	69	129	388	510	568	472	423	137	223
<b>2007</b>	54	39	87	295	337	342	360	266	88	150
<b>2008</b>	83	20	63	329	343	370	369	331	97	134
<b>2009</b>	24	11	54	276	364	407	465	409	107	134
<b>2010</b>	37	29	100	481	531	558	530	442	138	219
<b>1011</b>	26	33	126	565	578	630	620	554	177	294
<b>2012</b>	28	34	127	424	499	572	523	488	150	273
<b>2013</b>	39	31	101	451	505	532	539	481	481	217
<b>2014</b>	60	28	134	632	637	719	692	788	249	406

TABLE NO. 2

**Total deaths in given age groups due to Endocrine diseases from 2005-2014**

T3	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
<b>2005</b>	8	7	14	13	27	72	204	288	134	308
<b>2006</b>	7	903	617	417	325	367	610	695	328	891
<b>2007</b>	350	173	133	269	261	320	559	668	328	813
<b>2008</b>	564	173	141	273	276	339	518	608	303	803
<b>2009</b>	646	141	140	269	271	363	580	775	393	1019
<b>2010</b>	12	12	14	26	32	79	257	342	163	464
<b>2011</b>	8	40	35	32	38	2701	273	452	219	509
<b>2012</b>	62	28	32	59	52	105	320	469	211	446
<b>2013</b>	60	20	20	38	57	186	355	514	263	558
<b>2014</b>	60	29	11	28	40	134	389	528	272	510

TABLE NO. 3

**Total deaths in given age groups due to Bacterial diseases from 2005-2014**

T4	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
<b>2005</b>	80	1261	1014	778	648	646	665	699	38	851
<b>2006</b>	328	359	291	489	515	495	509	537	226	484
<b>2007</b>	188	422	411	753	770	767	832	753	311	716
<b>2008</b>	217	182	166	450	635	884	779	993	307	680
<b>2009</b>	645	195	177	314	507	942	796	944	383	684
<b>2010</b>	741	226	266	314	353	429	717	680	312	964
<b>2011</b>	784	217	227	304	361	462	685	900	403	1356
<b>2012</b>	745	192	231	257	343	459	634	877	413	1197
<b>2013</b>	762	195	241	310	427	527	737	1005	443	1293
<b>2014</b>	934	241	292	369	499	612	861	1076	477	1438

TABLE NO. 4

**Total deaths in given age groups due to Infectious diseases from 2005-14**

T5	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
<b>2005</b>	131	1676	1505	1493	1470	1422	1353	407	507	1167

<b>2006</b>	518	554	559	1026	1189	1194	1123	1051	398	747
<b>2007</b>	335	575	631	1182	1247	1249	1348	1139	441	952
<b>2008</b>	318	257	296	860	1138	1402	1304	1521	459	952
<b>2009</b>	708	295	335	719	1072	1553	1458	1524	536	968
<b>2010</b>	1448	524	736	1527	1736	1925	2272	2275	968	2468
<b>2011</b>	915	352	495	1064	1124	1283	1455	1580	635	1749
<b>2012</b>	1025	326	523	845	1038	1227	1328	1504	604	1564
<b>2013</b>	938	310	493	1006	1185	1311	1489	1679	735	1783
<b>2014</b>	1124	331	524	1147	1289	1495	1711	2098	772	1948

TABLE NO. 5

**Total deaths in given age groups due to Neoplasms from 2005-2014**

T6	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
<b>2005</b>	4	37	70	91	129	160	231	272	130	224
<b>2006</b>	22	28	59	99	90	156	279	339	144	240
<b>2007</b>	20	37	61	87	111	231	414	401	205	344
<b>2008</b>	27	56	66	122	186	241	510	544	190	258
<b>2009</b>	50	104	138	289	394	434	591	588	256	381
<b>2010</b>	293	112	212	386	558	681	922	1028	437	807
<b>2011</b>	745	242	297	825	902	1173	1581	1739	695	1067
<b>2012</b>	431	131	241	389	431	679	1093	1131	462	784
<b>2013</b>	128	83	184	278	305	544	807	917	331	532
<b>2014</b>	86	86	232	383	438	738	1104	1234	483	684

TABLE NO. 6

**Total deaths in given age groups due to Nervous system disorders from 2005-14**

T7	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
<b>2005</b>	2	24	42	31	22	36	45	32	19	38
<b>2006</b>	257	212	257	228	188	142	130	101	51	87
<b>2007</b>	227	229	227	146	155	176	174	142	57	109
<b>2008</b>	104	236	186	138	82	211	187	190	22	70
<b>2009</b>	111	263	205	134	174	279	207	193	39	71
<b>2010</b>	43	102	94	95	85	83	277	81	30	71
<b>2011</b>	44	139	181	77	87	82	85	104	34	72
<b>2012</b>	188	94	118	121	129	115	141	125	49	122
<b>2013</b>	185	106	154	137	115	139	164	153	72	135
<b>2014</b>	188	83	126	104	134	126	120	151	53	118

TABLE NO. 7

**Total deaths in given age groups due to Circulatory system diseases from 2005-14**

T8	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
<b>2005</b>	26	291	287	358	529	685	1063	1170	353	1272

<b>2006</b>	96	209	219	497	538	765	1105	1346	608	1451
<b>2007</b>	493	286	409	908	1159	1431	2028	2415	1231	3116
<b>2008</b>	363	272	330	916	1279	1489	2020	2432	1097	2734
<b>2009</b>	569	364	390	939	1280	1563	2099	2544	1176	2958
<b>2010</b>	198	120	200	476	697	944	1536	1600	708	1736
<b>2011</b>	173	122	154	426	578	873	1387	1801	772	2149
<b>2012</b>	263	98	205	510	716	1016	1585	1968	961	2098
<b>2013</b>	318	81	159	505	653	1003	1621	2008	916	2144
<b>2014</b>	271	84	163	408	592	908	1559	2184	892	2373

TABLE NO. 8

**Total deaths in given age groups due to Respiratory system diseases from 2005-14**

T9	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
<b>2005</b>	13	436	294	179	164	201	324	428	198	428
<b>2006</b>	223	164	120	98	117	152	307	424	208	494
<b>2007</b>	187	179	141	138	150	180	317	434	241	497
<b>2008</b>	170	176	134	128	178	346	205	507	292	558
<b>2009</b>	201	368	232	201	293	308	325	385	272	528
<b>2010</b>	476	182	154	231	285	336	536	556	264	726
<b>2011</b>	289	134	239	193	222	339	517	685	325	999
<b>2012</b>	491	144	130	209	240	348	570	770	369	944
<b>2013</b>	478	133	152	241	307	390	610	888	393	1063
<b>2014</b>	531	131	139	287	348	514	700	1110	456	1115

TABLE NO. 9

**Total deaths in given age groups due to Digestive system diseases from 2005-14**

T10	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
<b>2005</b>	12	89	78	144	189	284	291	209	74	137
<b>2006</b>	74	62	103	123	190	229	275	205	69	138
<b>2007</b>	59	48	66	108	186	273	331	273	83	177
<b>2008</b>	47	22	73	115	186	246	322	294	166	277
<b>2009</b>	49	23	38	205	286	324	385	248	171	173
<b>2010</b>	82	38	86	162	259	364	461	316	127	221
<b>2011</b>	117	67	93	243	334	484	514	449	143	242
<b>2012</b>	230	44	79	222	359	639	655	502	165	302
<b>2013</b>	127	31	73	195	366	565	566	473	159	259
<b>2014</b>	119	61	105	234	440	676	736	606	192	355

TABLE NO. 10

**Total deaths in given age groups due to accidents & consequences of external causes from 2005-14**

T11	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-69	>=70
2005	0	86	87	250	263	258	176	107	34	61
2006	24	88	119	395	404	347	258	182	65	141
2007	16	31	51	186	187	166	109	97	27	71
2008	30	30	34	104	132	156	171	201	49	123
2009	31	28	23	134	152	185	168	150	45	85
2010	219	47	85	197	249	257	344	403	170	485
2011	276	99	130	349	350	352	653	885	414	1107
2012	254	74	112	292	372	457	680	853	425	1205
2013	275	83	100	368	458	513	677	935	464	1225
2014	248	103	151	443	602	716	1041	1363	632	1776

TABLE NO. 11

We have tabulated the total number of deaths in the time period 2005-2014 (irrespective of these 10 mentioned diseases) for better analysis and understanding. In this part we also present the brief discussion about the proportion of MCCD considered as compared to total death along with % effect of major cause of death during the particular years. The data of total death and medically certified cause of death observed in CR office during the year are presented below. The proportionality of medically certified cause of death over total deaths is also presented for observation of coverage of deaths in T12:-

Year (T12)	Total Certified Causes of deaths	Total Death	Percentage of Certified Cause of Death over Total Death
2005	56390	94187	59.87
2006	60254	98908	60.92
2007	59256	100974	58.68
2008	57122	107600	53.09
2009	68373	112013	61.04
2010	76373	124353	61.42
2011	68326	112142	60.93
2012	67856	104616	64.86
2013	68135	97185	70.11
2014	74591	121286	61.5

TABLE 12.

Also, we are presenting the data of total cause of death considered of major ten diseases in this paper over the total cause of death observed by CRS data of Delhi CR office as per Annual Report in last ten years. The proportionality of coverage of certified cause of death i.e. considered 10 major diseases over the overall certified cause of death presented in Annual reports of Delhi for the time period 2005-2014 is also seen with its mean values.

Year (T13)	Coverage of total cause of deaths of 10 major diseases	Total Certified Cause of death	Percentage of coverage/considered deaths
2005	40003	56390	70.93%
2006	38668	60254	64.17%
2007	44999	59256	75.93%
2008	44010	57122	77.04%
2009	48285	68373	70.61%
2010	52757	76373	69.07%

2011	54413	68326	79.63%
2012	52027	67856	76.67%
2013	52922	68135	77.67%
2014	61222	74591	82.07%

**Analysis of variance (ANOVA)** is a collection of statistical methods used to analyze the differences among group means and their associated procedures such as "variation" among and between groups, developed by statistician and evolutionary biologist Ronald Fisher. In the ANOVA setting, the observed variance in a particular variable is partitioned into components attributable to different sources of variation. In its simplest form, ANOVA provides a statistical test of whether or not the means of several groups are equal, and therefore generalizes the *t*-test to more than two groups. ANOVAs are useful for comparing/testing three or more means (groups or variables) for statistical significance. It is conceptually similar to multiple two-sample *t*-tests, but is less conservative (results in less type I error) and is therefore suited to a wide range of practical problems.

**STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES:** SPSS is a widely used program for statistical analysis in social science. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners and others. The original SPSS manual (Nie, Bent & Hull, 1970) has been described as one of "sociology's most influential books" for allowing ordinary researchers to do their own statistical analysis. In addition to statistical analysis, data management (case selection, file reshaping, creating derived data) and data documentation (a metadata dictionary was stored in the datafile) are features of the base software. Statistics included in the base software: **Descriptive statistics:** Cross tabulation, Frequencies, Descriptives, Explore, Descriptive Ratio Statistics. **Bivariate statistics:** Means, *t*-test, ANOVA, Correlation (bivariate, partial, distances), Nonparametric tests. **Prediction for numerical outcomes:** Linear regression. **Prediction for identifying groups:** Factor analysis, cluster analysis (two-step, K-means, hierarchical), Discriminate. The many features of SPSS Statistics are accessible via pull-down menus or can be programmed with a proprietary 4GL *command syntax language*. Command syntax programming has the benefits of reproducibility, simplifying repetitive tasks, and handling complex data manipulations and analyses. Additionally a "macro" language can be used to write command language subroutines. A Python programmability extension can access the information in the data dictionary and data and dynamically build command syntax programs. SPSS Statistics places constraints on internal file structure, data types, data processing, and matching files, which together considerably simplify programming. SPSS datasets have a two-dimensional table structure, where the rows typically represent cases (such as individuals or households) and the columns represent measurements (such as age, sex, or household income). Only two data types are defined: numeric and text (or "string"). All data processing occurs sequentially case-by-case through the file. Files can be matched one-to-one and one-to-many, but not many-to-many. In this entire work, we have used the **Independent sample t test**.

**ANALYSIS & INTERPRETATIONS** we have performed analysis of variance (ANOVA) to establish the relationship between years and diseases for checking the exact variation of occurrences of diseases over the years. Also, we have done that for Disease wise analysis with respect of Age Group over the Years .

Lastly, we have used the independent *t*-test to understand whether our 10 major diseases (individually) differ based on gender for our period of study 2005-2014. we have to establish the relationship b/w two factors i.e. Years and Diseases for checking the exact variation of occurrences of diseases over the years: Let us define the Hypothesis for Total deaths from *j*th disease in *i*th year, (*i*=2005, 2006,.....2014 , *j*=1,2,.....10 ) =  $y_{ij}$ .

**Null Hypothesis:**

$H_{OY} : \mu_{2005} = \mu_{2006} = \dots = \mu_{2014}$  ,i.e .there is no significant difference among the years.

$H_{OD} : \mu_{.1} = \mu_{.2} = \dots = \mu_{.10}$ , i.e there is no significant difference among the diseases.

**Alternative Hypothesis:**

$H_{1Y}$ : At least two of  $\mu_{2005}$  ,  $\mu_{2006}$ , . . . . ,  $\mu_{2014}$  are different, i.e at least two of the years differ significantly.

$H_{1D}$ : At least two of the  $\mu_{.1}$  ,  $\mu_{.2}$ , . . . . .  $\mu_{.10}$  are different, i.e at least two of diseases significantly different.

In usual notations, we have:  $k=10$ ,  $h=10$ , and  $N=h*k=10*10=100$

**Assumptions :**

ANOVA test is based on the test statistics *F* (i.e. variance ratio)

For the validity of the *F*-test in ANOVA, the following assumptions are made:

1. The observations are independent.

2. Parent population from which the observations are taken is normal
3. Various treatment & environmental effects are additive in nature.

Calculations: (with respect to data in Table no. 1)

$$R.S.S = \sum \sum y_{ij}^2 = 3566467568$$

$$Correction\ Factor = (G^2)/N = 2394203616$$

$$Total\ S.S = R.S.S - C.F = 3566467568 - 2394203616 = 1172263952$$

$$Row\ Sum\ of\ squares = \frac{\sum_i T_i^2}{10} - C.F = 511.04$$

$$Column\ Sum\ of\ squares = \frac{\sum_j T_j^2}{10} - C.F = 719.2$$

$$Error\ Sum\ of\ squares = T.S.S - Row\ S.S - Col\ S.S = 237209721.4$$

ANOVA TABLE(T14)				
Sources of Variation	Sum of squares	Degrees of freedom	Mean sum of squares	F statistic
Between columns( diseases)	890413719.2	10-1=9	98934857.69	33.78
Between Rows (years)	44640511.04	10-1=9	4960056.782	1.69
Error	237209721.4	9*9=81	2928515.079	
Total	1172263952	10*10-1=99		

### Conclusion

**(Based on T14):** Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 33.783 is greater than the tabulated value, it is significant and  $H_{0D}$  is rejected at 5% level of significance and we conclude that there is significant difference among the diseases. Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 1.693 is less than the tabulated value, it is not significant and  $H_{0Y}$  is accepted at 5% level of significance and we conclude that there is no significant difference among the diseases.

#### Disease wise analysis with respect of Age Group over the Years using ANOVA

To set the Hypothesis over the age groups and years as :-

*For Age Groups (taken in columns)*

**Null Hypothesis ( $H_{0A}$ ) :** There is no significant difference in the death toll for different age groups for that particular disease.

**Alternative Hypothesis ( $H_{1A}$ ):** There is a significant difference in the death toll for different age groups for that particular disease.

*For Years (taken in rows)*

**Null Hypothesis ( $H_{0Y}$ ):** There is no significant difference in the death toll for different years for that particular disease.

**Alternative Hypothesis ( $H_{1Y}$ ):** There is a significant difference in the death toll for different years for that particular disease.

#### Analysis & Interpretations based on ANOVA

##### TUBERCULOSIS Calculations done with reference to table no. 2

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.347 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.

Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.086 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Tuberculosis.

#### ENDOCRINE, NUTRITIONAL & METABOLIC DISEASES

*Calculations done with reference to table no. 3*

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.345 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups.

Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.89 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Endocrine diseases.

**BACTERIAL DISEASES:** *Calculations done with reference to table no. 4*

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.127 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups. Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.13 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Bacterial diseases.

**INFECTIOUS & PARASITIC DISEASES:** *Calculations done with reference to table no. 5*

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.116 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups. Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.09 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Infectious & Parasitic diseases.

**NEOPLASMS:** *Calculations done with reference to table no. 6*

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.309 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups. Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.41 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Neoplasms.

**NERVOUS SYSTEM DISORDERS:** *Calculations done with reference to table no. 7*

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.065 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups. Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.19 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Nervous system disorders.

**CIRCULATORY SYSTEM DISEASES:** *Calculations done with reference to table no. 8*

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.437 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups. Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.09 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Circulatory system diseases.

**RESPIRATORY SYSTEM DISEASES:** *Calculations done with reference to table no. 9*

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.240 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups. Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.152 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Respiratory System diseases.

**DIGESTIVE SYSTEM DISEASES:** *Calculations done with reference to table no. 10*

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.333 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups. Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 9.154 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for the above mentioned disease-Digestive system diseases.

**ACCIDENTS & CONSEQUENCES OF EXTERNAL CAUSES:-** *Calculations done with reference to table no. 11*

Tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 0.49 is less than the tabulated value, it is not significant and ( $H_{0A}$ ) is accepted at 5% level of significance and we conclude that there is no significant difference among the age groups. Again, tabulated  $F_{0.05}$  for (9,81) d.f is 1.997 and since the calculated value of F, i.e 7.869 is more than the tabulated value, it is significant and ( $H_{0Y}$ ) is rejected at 5% level of significance and we conclude that there is significant difference among the years 2005-2014 for

the above mentioned cause -Accidents & Consequences of external causes.Thus, making a general conclusion of these individual ANOVA tests (taking age groups & years) we can say that the death toll due to all these causes has taken a significant leap from 2005 to 2014.This may be due to so many varied reasons , say, bad sanitation facilities, growing population & poverty, improper and inadequate medical facilities, lack of education, etc.

Now days, it is seem that data analysis work is mostly performed on either by SPSS and SAS for getting maximum accuracy and better conclusion of results. In this report we are using SPSS version 22.0 for analysis of various result in the direction of achieving the desired object of the research. We have already worked out above result with the help of available statistical software in DES, Delhi. Now we are presenting the analysis of independent sample t-test for these ten diseases as compared to gender which are seen in next part.Herewe have used the independent t-test to understand whether our 10 major diseases (individually) differ based on gender for our period of study 2005-2014(i.e., your dependent variable would be "Male & Female deaths due to respective diseases" and your independent variable would be "gender", which has two groups: "male" and "female").

The null hypothesis for the independent t-test is that the population means from the two unrelated groups (Male & Female) are equal:  
 $H_0: u_1 = u_2$

In most cases, we are looking to see if we can show that we can reject the null hypothesis and accept the alternative hypothesis, which is that the population means are not equal:

$H_A: u_1 \neq u_2$

To do this, we need to set a significance level (alpha) that allows us to either reject or accept the alternative hypothesis. Most commonly, this value is set at 0.05.

The SPSS Output Result of t-test for ten considered diseases are seen as in Table 15 to 24:-

- **Accidents & consequences of external causes**

**Group Statistics**

T15(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	3646.40	1765.339	558.249
	Female	10	2051.20	1040.488	329.031

**Independent Samples Test**

T15(b)	Levene's Test for Equality of Variances	t-test for Equality of Means								
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Deaths	Equal variances assumed	5.659	.029	2.46	18	.024	1595.2	648.00	233.80	2956.59
	Equal variances not assumed			2.46	14.58	.027	1595.2	648.00	210.54	2979.85

- **Bacterial diseases**

**Group Statistics**

T16(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	3440.00	456.171	144.254
	Female	10	2267.10	416.717	131.777

**Independent Samples Test**

T16(b)	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
Deaths Equal variances assumed	.064	.803	6.00	18	.000	1172.90	195.38	762.41	1583.38	
Deaths Equal variances not assumed			6.00	17.85	.000	1172.90	195.38	762.17	1583.62	

• **Circulatory system diseases**

**Group Statistics**

T17(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	6261.20	1696.507	536.483
	Female	10	3615.50	1012.927	320.316

**Independent Samples Test**

T17(b)	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
Deaths Equal variances assumed	3.253	.088	4.23	18	.000	2645.70	624.83	1332.97	3958.42	
Deaths Equal variances not assumed			4.23	14.69	.001	2645.70	624.83	1311.47	3979.92	

• **Digestive system diseases**

**Group Statistics**

T18(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	1603.40	547.396	173.102
	Female	10	664.60	197.237	62.372

**Independent Samples Test**

T18(b)	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	

								ce	Lower	Upper
Deaths	Equal variances assumed	12.655	.002	5.10	18	.000	938.800	183.996	552.239	1325.36
	Equal variances not assumed			5.10	11.29	.000	938.80	183.99	535.12	1342.47

• **Endocrine, nutritional & metabolic diseases**

**Group Statistics**

T19(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	1590.00	876.719	277.243
	Female	10	1196.00	593.365	187.639

**Independent Samples Test**

T19(b)	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Deaths	4.666	.044	1.177	18	.255	394.00	334.77	-309.32	1097.32
			1.177	15.81	.257	394.00	334.77	-316.35	1104.35

• **Infectious & Parasitic diseases**

**Group Statistics**

T20(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	6607.20	1354.191	428.233
	Female	10	4035.10	953.981	301.675

**Independent Samples Test**

T20(b)	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Deaths	.278	.604	4.910	18	.000	2572.10	523.82	1471.58	3672.61
			4.910	16.168	.000	2572.10	523.82	1462.57	3681.62

• **Neoplasms**

**Group Statistics**

T21(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	2475.10	1513.081	478.478
	Female	10	1568.90	980.575	310.085

**Independent Samples Test**

T21(b)	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Deaths	3.823	.066	3.765	18	.001	308.70	81.99	136.43	480.96
				13.656	.002	308.70	81.99	132.41	484.98

- **Nervous system disorders**

**Group Statistics**

T22(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	830.80	229.298	72.510
	Female	10	522.10	121.066	38.284

**Independent Samples Test**

T22(b)	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Deaths	3.823	.066	3.765	18	.001	308.70	81.99	136.43	480.96
				13.656	.002	308.70	81.99	132.41	484.98

- **Respiratory system diseases**

**Group Statistics**

T23(a)	Male_Female	N	Mean	Std. Deviation	Std. Error Mean
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Deaths	Male	10	2221.30	588.675	186.155
	Female	10	1298.80	419.407	132.628

**Independent Samples Test**

T23(b)	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
Deaths Equal variances assumed	1.767	.200	4.03	18	.001	922.50	228.57	442.29	1402.70	
Deaths Equal variances not assumed			4.03	16.265	.001	922.50	228.57	438.59	1406.40	

• **Tuberculosis**

**Group Statistics**

T24(a)	Male_female	N	Mean	Std. Deviation	Std. Error Mean
Deaths	Male	10	2008.80	479.362	151.587
	Female	10	1003.80	245.748	77.712

**Independent Samples Test**

T24(b)	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
Deaths Equal variances assumed	1.825	.193	5.90	18	.000	1005.00	170.34	647.115	1362.88	
Deaths Equal variances not assumed			5.90	13.42	.000	1005.00	170.34	638.170	1371.83	

**Interpretation of Independent t test for the disease- TUBERCULOSIS(T15):** Looking at the group statistics table, we may conclude that male deaths due to tuberculosis are nearly double to that of female deaths due to the same disease for the whole tenure of 2005-2014.

Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to tuberculosis differ significantly.

The F value = 1.825. From the 95% confidence interval, we conclude that the difference of male & female deaths due to tuberculosis ranges on an average from 640-1365.

**Interpretation of Independent t test for the disease- Endocrine diseases (T16) :** Looking at the group statistics table, we may conclude that male deaths due to endocrine problems are greater than female deaths due to the same disease for the whole tenure of 2005-2014.

The group means (male & female) are not significantly different as the sig(2-tailed value) is more than 0.05. Thus, male and female deaths due to endocrine problems do not differ significantly.

The F value = 4.666. From the 95% confidence interval, we conclude that the difference of male & female deaths due to Endocrine and Metabolic diseases ranges on an average from 0-1100. Negative value shows there is non-linearity between the smallest observed value and a value of 0, and the inference on the intercept should therefore be ignored.

**Interpretation of Independent t test for the disease- Infectious diseases(T17):** Looking at the group statistics table, we may conclude that male deaths due to infectious diseases are greater than female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to infectious diseases differ significantly. The F value = 0.278. From the 95% confidence interval, we conclude that the difference of male & female deaths due to Infectious diseases ranges on an average from 1471-3672.

**Interpretation of Independent t test for the disease- Bacterial diseases(T18):** Looking at the group statistics table, we may conclude that male deaths due to bacterial diseases are greater than female deaths due to the same disease for the whole tenure of 2005-2014.

Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to bacterial diseases differ significantly.

The F value = 0.064. From the 95% confidence interval, we conclude that the difference of male & female deaths due to Bacterial diseases ranges on an average from 762-1583.

**Interpretation of Independent t test for the disease- Neoplasms(T19):** Looking at the group statistics table, we may conclude that male deaths due to neoplasms is greater than female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are not significantly different as the sig(2-tailed value) is more than 0.05. Thus, male and female deaths due to neoplasms do not differ significantly. The F value = 1.441. From the 95% confidence interval, we conclude that the difference of male & female deaths due to Neoplasms ranges on an average from 0-2104. Negative value shows there is non-linearity between the smallest observed value and a value of 0, and the inference on the intercept should therefore be ignored.

**Interpretation of Independent t test for the disease- Nervous system disorders(T20):** Looking at the group statistics table, we may conclude that male deaths due to nervous system disorders are greater than female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to nervous system problems differ significantly. The F value = 3.823. From the 95% confidence interval, we conclude that the difference of male & female deaths due to Nervous system disorders ranges on an average from 136-481.

**Interpretation of Independent t test for the disease- Circulatory problems(T21):** Looking at the group statistics table, we may conclude that male deaths due to circulatory system diseases is nearly double to that of female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to circulatory problems differ significantly. The F value = 3.253

From the 95% confidence interval, we conclude that the difference of male & female deaths due to Circulatory system diseases ranges on an average from 1333-3958.

**Interpretation of Independent t test for the disease- Respiratory problems(T22):** Looking at the group statistics table, we may conclude that male deaths due to respiratory problems are greater than female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to respiratory problems differ significantly. The F value = 1.767. From the 95% confidence interval, we conclude that the difference of male & female deaths due to Respiratory system diseases ranges on an average from 442-1403.

**Interpretation of Independent t test for the disease- Digestive problems(T23):** Looking at the group statistics table, we may conclude that male deaths due to digestive system problems is even greater than double to that of female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to digestive problems differ significantly. The F value = 12.655. From the 95% confidence interval, we conclude that the difference of male & female deaths due to Digestive system diseases ranges on an average from 552-1325.

**Interpretation of Independent t test for the disease- Accidents(T24):** Looking at the group statistics table, we may conclude that a male death due to accidents & consequences of external causes is greater than female deaths due to the same disease for the whole tenure of 2005-2014. Also the group means (male & female) are significantly different as the sig(2-tailed value) is less than 0.05. Thus, male and female deaths due to accidents & consequences of external causes differ significantly. The F value = 5.659. From the 95% confidence interval, we conclude that the difference of male & female deaths due to accidents & consequences of external causes ranges on an average from 234-2957.

**LIMITATIONS:** Since, only major 10 medically certified causes of death are taken into consideration; it doesn't serve the purpose of studying all the causes (the population). When information about each unit/cause of population is required, complete enumeration of causes is required. Moreover, as discussed, the ANOVA is valid only under certain assumptions, denying to which it will lead to illogical results and interpretations. Thus, the assumptions are to be stringently kept into mind before reading ANOVA. Same is the case with independent sample t test. We are unable to give the optimum suggestion to government due to unavailability of data on socio-economic condition of disease affected person. Health facilities provided by government are not known or not taken in this research work.

**CONCLUSION:** The analysis of causes of death is an optimum way to know the relative impact of the particular diseases on the life. This way, it may also help to improve the health facilities for preventing from these diseases after formulating the better plan and introducing the various schemes. Government may also improve the health facilities for prevention of most fatal diseases among the various age groups of persons who are mostly affected. The conclusion drawn from investigating the major death causing diseases in Delhi Region from reveals that: ■Infectious & Parasitic diseases, Circulatory system diseases, neoplasms, Respiratory system diseases, bacterial diseases and accidental death cases claimed more lives. ■It can be concluded that the cause-specific death ratios based on the objective of study indicated that among the leading causes of death Infectious & Parasitic diseases, Circulatory system diseases, and Bacterial diseases and accidents were the most common. ■It is necessary to point out that Infectious & Parasitic diseases, bacterial diseases and accidental deaths demonstrated an upward trend while that of circulatory system diseases exhibited a pattern of downward trend. Future expected death cases from Infectious & Parasitic diseases, bacterial diseases and accidents may increase while that of Circulatory system may decrease throughout the forecasted period of study. For a better conclusion to be realized, future studies may involve other institutions to come forward with the current situation. It is also necessary for the government to channel resources in this area to alleviate the trend of the diseases.

**SUGGESTIONS & FUTURE PROSPECTS:** There should be a campaign, in support by youth on major diseases as control programs. Major issues include lack of qualified and well equipped trained staff, limited availability of medications and insufficient financial resources. The Government and civil society must take a series of actions to review and develop health legislation and a comprehensive strategy and policy to promote the health care delivery service in the Delhi. There must be an improvement in the data capture on morbidity and mortality. Departments can organize routine data management training for the staffs who are responsible for all records relating to the health service. The ministry of health should collaborate with the food and drugs Board to monitor the quality of food and drugs imported at road check points. Scientists revealed that, the body loses and replaces approximately 1.5 million skin cells every hour. It is very essential to bath frequently, at least twice daily. This helps to prevent skin infections. Sweats and oil secretions on the skin enable bacteria and fungi to breed easily. Finger nails should always be kept short and clean so that they do not provide breeding grounds for germs. The spaces between teeth where food particles are trapped provide convenient breeding grounds for bacteria. Hence teeth should therefore be cleaned at least twice every day, in the morning and preferably in the evening after meal. In addition to cleanliness, other factors which are important in promoting health include exercises, recreation and rest. Exercises make the muscles strong and help to get rid of metabolism as well as improving the action of glands and the nervous system. Recreation such as gardening, reading and playing games can remove any dullness, stress and mental tiredness resulting from every day's work. The best form of rest is sleep. Adults need eight hours sleep daily. A great deal of repair of worn-out tissues in the body and the building up of new ones takes place when the body rests. Other good personal habits include avoiding smoking and alcoholic drinks. Moreover, there should be yearly promotional campaigns on vaccination and immunization program against communicable diseases by the government and the Ministry of Health (M H O). The Ministry of Health in collaboration with the World Health Organization (WHO), if possible, should establish law enforcement against cigarette smoking in public.

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research analysis. Fourth author always engaged in checking the statistical table and its accuracy presented in various tables especially in research analysis part of paper.

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# Dissociation Energies of CaO, BaO and SrO

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## Abstract

Two different methods for measuring dissociation energy have been employed.

1: 'a' Parameter ( a being the ratio of Lorentz broadening to Doppler broadening) of Ca and Sr first resonance lines and of the Na II-doublet has been derived from self absorption by applying a combination of the methods of " Flame duplication" and the "curve of Growth" method.

2: Emission measurement were performed in premixed Laminar, Shielded Co-Na-Os flames at atmospheric pressure with nearly stoichiometric composition of the un-burnt gases. Temperatures ranged from 2200 to 2500<sup>0</sup> K. The flame emission was detected with a linear photo-meter involving periodic light-chopper & phase sensitive detection. Present result agrees with experimental data of literature value.

**Key words:** Dissociation energies, emission measurement, temperature, alkaline metals, flame emission.

## I. Introduction

The dissociation energy of Alkaline, CaO, SrO& BaO as derived from flame photo-metric measurements, originates from the uncertainty with regard to the emitter of the band spectra, the designation & energy of the ground and excited state levels, respectively. The 'a' parameter of the atomic resonance lines involved, and the possible side reaction may lead to the formation of hydroxides, which may also give visible band emissions. We have tried to eliminate the uncertainty about the emitter by using 'dry' co-air flames containing virtually no hydrogen compound). Comparing the result with those of similar (moist) flames into which a small amount of water vapor was introduced [1-17].

Salt of alkaline earth was fed into the 'dry' flame by dry evaporation of the salt in a heated pot placed in the N<sub>2</sub> conduct to the flame besides the height of the upper excitation level of the bands observed could be deduced from measured temperature dependence of the band on temperature of the metal oxide concentration and flame depth. Plotting the observed intensities semi logarithmically against reciprocal temperature directly yields the excitation energy [18-19].

## II. Calculations

In first method of determining dissociation energies, the ratio of band intensity to line intensity was measured at two different temperatures and at two heights in both the moist and dry flames. The following lines and bands were investigated: Ca 4227 A line, 5540 & 6220 A bands, the Sr 4607 A Line and 6050 & 6050 & 6660 A bands, the Ba 5536 A line & A 5350 band with a particular element & at a given height in the flame , the ratio of the dissociation constants K( Tr) / K(T5) at two temperatures follows from the ratio, UI/O/UM of band to line intensities measured at these temperatures according to

$$\frac{K(T_1)}{K(T_2)} = \left(\frac{u_M}{u_{MO}}\right)_{T_1} \cdot \left(\frac{u_{MO}}{u_M}\right)_{T_2} \cdot \frac{(O)_{T_1}}{(O)_{T_2}} \cdot \exp\left\{(E_M - E_{MO})\left(\frac{1}{kT_1} - \frac{1}{kT_2}\right)\right\}$$

Here O(T1)/O(T2) is the ratio of atomic oxygen constants in the two flames as calculated from their equilibrium gas composition and temperature. E<sub>M</sub> and E<sub>ms</sub> are the energies of excitation levels of the metal atom of the (resonance) lines and of the bands. It is found from the equation that, the dissociation energy of the reaction MO → tM + O with M representing the alkaline earth metal. A second

independent method for determining dissociation energy was carried out with two variants. The method is essentially based upon the variation of the ratio  $M/M_o$  from the line intensity measurement only. Self absorption measurement involving the resonance line of Ca and Sr yield the absolute atomic concentration of this atom in the flame. The total concentration  $M+M_o$  can be calculated from the absolute sodium concentration measured through the self absorption of Na-D lines. When a Na solution of equal molarity as the Ca or Sr solution was sprayed into the flame. It was assumed that no Na molecules are formed in the flame. Allowance is made for ionization effects. The ratio  $M/M_o$  thus found multiplied by the calculated equilibrium atomic oxygen concentration yields the absolute value of dissociation constant from which the dissociation energy follows, if the partition function of the molecule is known. The partition function involves inter alia the statistical weight factor of the molecular ground state level.

The resonance line intensities of Ca, Sr and Ba have also been measured in comparison with the intensity of the Na D-lines for low salt concentrations where self absorption is not important and ionization is suppressed or allowed for. From these relative intensities the atomic alkaline-earth concentrations in the flame can be expressed in terms of the Na concentration, provided the oscillator strengths of all transitions involved and the relative sensitivity of the photometer as a function of wavelength are known. Following the same procedure as discussed sub (i), the ratio  $(M)/(M_o)$  and then the dissociation energy can be calculated, if one, again, assumes that all alkaline earth molecules formed are oxides.

It should be noted that with the two variants (i) and (ii), knowledge of the excitation energies of the bands is not required, but that the spectroscopic designation of the molecular ground state must be known. The latter does not play a part in method I. Comparison of the results for DMO found in methods I and II shows that the best mutual agreement is found if the ground state is assumed to be a triplet state, most probably a  $^3\Pi$  state. This holds for Ca as well as Sr and Ba. The dissociation energy obtained using both methods shown in **Table 1**.

**Table 1:** Dissociation energy of alkaline earth metal oxides

	Dissociation energy (in eV): $MO \rightarrow M + O$			
	Method I		Method II	
	(from band/line intensities) "moist" CO-flame	"dry" CO-flame	(from absolute atomic concentrations) (i) from self absorption	(ii) from line intensity ratios
CaO	$3.9 \pm 0.1$	$3.9 \pm 0.15$	$3.9 \pm 0.1^*$	$4.1 \pm 0.1^*$
SrO	$4.1 \pm 0.1$	$4.2 \pm 0.15$	$4.1 \pm 0.1^*$	$4.0 \pm 0.1^*$
BaO	$4.8 \pm 0.1$	$4.9 \pm 0.15$	— †	$5.0 \pm 0.2^*$

\* The molecular ground state is assumed to be a  $^3\Pi$  state; for a  $^3K$  state all values would have been raised by 0.1 eV.

† Self-absorption was not strong enough in the concentration range available.

### III. Discussion

In the present work the dissociation energy of CaO, BaO, SrO are obtained by performing premixed Laminar Shielded Ca-Na-O<sub>2</sub> flames at atmospheric unburnt gases & a parameter of Ca & Sr first resonance lines of the Na II doublet was derived from self absorption by applying a combination of the method of the flame duplication present result agree with experimental data and literature value [20-23].

(Comparisons of our results with literature values)

	Head of band (Å)	Excitation energy, $E_{MO}$ , (in eV)			
		This work	HULDT and LAGERQVIST <sup>(6)</sup>	MAVRODINEANU <sup>(7)</sup>	$E_{MO}$ (this work) $-hc/\lambda$
CaO	5540	$3.14 \pm 0.03$	4.47	—	$0.90 \pm 0.03$
	6220	$2.99 \pm 0.03$	3.97	1.99	$1.00 \pm 0.03$
SrO	6050	$2.89 \pm 0.03$	3.47	—	$0.84 \pm 0.03$
	6660	$2.80 \pm 0.03$	3.35	—	$0.94 \pm 0.03$
BaO	5350	$2.92 \pm 0.03$	—	2.32	$0.60 \pm 0.03$

#### IV. Conclusion

Present study involves two different methods for measuring the dissociation energy. Comparison of the result of these independent method lead to the conclusion about designation of the molecular ground state of the oxides and about the validating of the assumption made. Our result is in good agreement with literature values.

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# Pharmaceutical Care – A case study of Connaught Hospital

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**Abstract- Background** –Pharmacy practice has shifted from a product centred approach to a patient centred approach. This study evaluated the need for and impacts that pharmaceutical care services at the ward level would have at Connaught Hospital, Freetown

**Objective** –To identify medication related problems, and assess the need for , relevance and impact of pharmaceutical care in this setting

**Methods** – Adapted Validated observational instruments for rating the value of Pharmacists clinical services and for assessing medication related problems and recommendations (interventions) were used to evaluate the severity of error, value of pharmaceutical care service, identify medication related problems and recommend solutions to these problems

**Results:** Of the 150 cases 77 had errors that were relevant, and 53% (80 of 150) of the services rendered were important. Medication related problems identified and recommendations were all shown to have a potentially positive impact on patient wellbeing and therapeutic outcomes as well as direct or indirect cost saving impact

**Conclusion:** There is a need for pharmaceutical care services and patient care will improve significantly when it is present

**Index Terms-** Pharmaceutical Care, Medication Related Problems, severity of error, value of service

## I. INTRODUCTION

The role of pharmacists have diversified from dispensing medications, to patient care, patient counsellor ,health care education and community service to clinical practice. Clinical and cost-effectiveness evidence are needed to justify the existence or extension of routine clinical pharmacy services in hospital settings.

The role of Clinical Pharmacists in the care of hospitalised patients has evolved over time with increased emphasis on collaborative case handling. Clinical Pharmacists are involved in the optimization of the Health care delivery system by fully participating in pharmaceutical care and identifying drug therapy problems and medication errors. In Sierra Leone as in some other West African countries this role is non-existent. This study seeks to evaluate the impact of that gap and the impact of pharmaceutical care will have on the quality of health care delivery and the optimization of medicine use in a resource limited setting such as Connaught hospital.

Clinical pharmacy practice in the form of pharmaceutical care and therapeutic interventions by the Pharmacist in the hospital setting in Sierra Leone is practically non-existent. This study will seek to evaluate tangible potential clinical pharmacy interventions that could have cut down costs, improved therapeutic goals of treatment outcomes and improve the quality of life of the patient and thus evaluate or verify the relevance of clinical pharmacists in improving the health care delivery in the hospital setting.

## II. OBJECTIVES OF STUDY

- To evaluate potential clinical pharmacy interventions at Connaught hospital.
- To determine the severity of errors of medication related problem and value of service if pharmaceutical interventions and hence the whether such interventions would be important
- To determine the frequency of occurrence of specific drug therapy problems
- To determine qualitatively any indirect cost savings due to improved patient safety and reduced morbidity and mortality.

A study was conducted by Busman et al to evaluate pharmacist clinical interventions in a Dutch hospital setting<sup>[1]</sup> The objective of the study was to assess the relevance of a clinically active pharmacist method compared to the traditional working method.

It was concluded that Clinical pharmacy services provided by a junior hospital pharmacist on an internal medicine ward contributed to rationalization of drug therapy and was therefore likely to increase medication safety.

In a study done on medication errors and adverse drug events in paediatric inpatients by the Harvard Medical Practice Study<sup>[2]</sup> it was estimated that 3.7% of hospitalized patients experienced an adverse event related to medical therapy in New York State in 1984<sup>[2]</sup> A more recent study reached similar estimates.<sup>[3]</sup> \ An Institute of Medicine report in 1999 estimated that 44 000 to 98 000 people die each year at least in part because of medical error<sup>[4]</sup> (Kohn et al ,1999

In the Harvard Medical Practice Study, the most common adverse events were complications of medication use (19.4% of all events).<sup>[5]</sup> Thirty percent of patients with drug-related injuries died or were disabled for more than 6 months, although not all morbidity and mortality was directly attributable to these drug-related injuries.<sup>[2]</sup> In response to these concerned findings, the Adverse Drug Event Prevention Study was performed, which addressed medication errors and adverse drug events (ADEs) in

hospitalized adults in more detail.<sup>[6][7]</sup> It found that ADEs were common (occurring at a rate of 6.5 per 100 adult admissions), costly, and often had severe sequelae.<sup>[6][7]</sup> Other studies largely confirmed these findings.<sup>[8]</sup>

Two studies suggest that about one third of ADEs were associated with medication errors and were thus preventable.<sup>[6]</sup> Bates et al found that medication errors were common, occurring at a rate of 5 per 100 medication orders. However, only 7 in 100 medication errors had significant potential for harm, and 1 in 100 actually resulted in an injury.<sup>[7]</sup>

A clinical pharmacist participating in physician rounds in an adult ICU decreased preventable ADEs by 66%.<sup>[7]</sup> In addition, ward-based interventions may reduce costs of care. During a 3-month study, a clinical pharmacist made 345 interventions in an adult ICU, leading to a \$24 000 cost reduction.<sup>[9]</sup>

A study was done by Dean et al titled - Prescribing errors in hospital inpatients: their incidence and clinical significance.<sup>[10]</sup> This study was based on the estimation that 1–2% of US inpatients are harmed by medication errors, the majority of which are errors in prescribing. The UK Department of Health has recommended that serious errors in the use of prescribed drugs should be reduced by 40% by 2005; however, little is known about the current incidence of prescribing errors in the UK. This pilot study sought to investigate their incidence in one UK hospital. Pharmacists prospectively recorded details of all prescribing errors identified in non-obstetric inpatients during a 4 week period. The number of medication orders written was estimated from a 1 in 5 sample of inpatients. Potential clinical significance was assessed by a pharmacist and a clinical pharmacologist. About 36 200 medication orders were written during the study period, and a prescribing error was identified in 1.5% (95% confidence interval (CI) 1.4 to 1.6). A potentially serious error occurred in 0.4% (95% CI 0.3 to 0.5). Most of the errors (54%) were associated with choice of dose. Error rates were significantly different for different stages of patient stay ( $p < 0.0001$ ) with a higher error rate for medication orders written during the inpatient stay than for those written on admission or discharge. While the majority of all errors (61%) originated in medication order writing, most serious errors (58%) originated in the prescribing decision. It was concluded that there were about 135 prescribing errors identified each week, of which 34 were potentially serious.

The impact of clinical pharmacists' consultations on geriatric drug prescribing was studied in a prospective randomized controlled trial of patients 65 years of age and over discharged on 3 or more medications for chronic conditions from a 450-bed community hospital.<sup>[11]</sup> The pharmacists provided consultation to experimental patients and their physicians at hospital discharge and at periodic intervals for 3 months post discharge. Using a standardized tool, a physician-pharmacist panel, blinded to study group assignment of patients, evaluated the appropriateness of prescribing for a random sample of 236 patients. Eighty-eight percent had at least one or more clinically significant drug problems, and 22% had at least one potentially serious and life-threatening problem. Drug-therapy problems were divided into six categories: 1) inappropriate choice of therapy; 2) dosage; 3) schedule; 4) drug-drug interactions; 5) therapeutic duplication; and 6) allergy. Experimental patients

were less likely to have one or more prescribing problems in any of the categories ( $P = 0.05$ ) or in the appropriateness ( $P = 0.02$ ) or dosage ( $P = 0.05$ ) categories. A summary score, measuring the appropriateness of the patient's total drug regimen, indicated that experimental patients' regimens were more appropriate than those of controls ( $P = 0.01$ ). Results of this trial reveal that clinical pharmacists can improve the appropriateness of geriatric drug prescribing in outpatient settings.

In a study titled economic effects of clinical pharmacy interventions: A literature review<sup>[12]</sup> A variety of clinical pharmacy interventions have been assessed, but the body of evidence relating to any particular type of intervention is small. Cost-saving interventions comprise a small percentage of clinical pharmacy interventions, but they generated substantial savings. Clinical pharmacists provided added value by participating in multidisciplinary teams attending rounds. Clinical pharmacy interventions reduced preventable adverse drug events and prescribing errors, thereby yielding savings related to cost avoidance. Interventions relating to antibiotic therapy lowered costs of care without adversely affecting clinical outcomes. The results of cost-benefit analyses suggested that general clinical pharmacy interventions are associated with cost savings. Most economic evaluations of clinical pharmacy interventions suffered from a number of methodological limitations relating to the absence of a control group without clinical pharmacy interventions, limited scope of costs and outcomes, focus on direct health care costs only, exclusion of pharmacist employment cost, use of intermediate outcome measures, exclusion of health benefits, and absence of incremental cost analysis. Some avenues for designing future economic evaluations include the use of a control group, detailed descriptions of the interventions provided; evaluations conducted from a societal perspective, consideration of patients' health benefits when assessing economic effect of interventions and hospital costs, and the inclusion of sensitivity and incremental analyses.<sup>[12]</sup>

It was concluded that most pharmaco-economic evaluations of clinical pharmacy interventions demonstrated limitations in their methodological quality and applicability to current practice. Future evaluations should use a comparative study design that includes the incremental cost-effectiveness or cost: benefit ratio of clinical pharmacy interventions from a societal perspective. A study was done titled: Reduction in Heart Failure Events by the Addition of a Clinical Pharmacist to the Heart Failure Management Team Results of the Pharmacist in Heart Failure Assessment Recommendation and Monitoring (PHARM).<sup>[13]</sup> The basis of this study was that multidisciplinary approach to managing heart failure has been shown to improve outcomes. The role of a clinical pharmacist in treating heart failure had not been evaluated. It was concluded that outcomes in heart failure can be improved with a clinical pharmacist as a member of the multidisciplinary heart failure team.

A study was done to evaluate cost implications of and potential adverse events prevented by interventions of a critical care pharmacist<sup>[14]</sup> A decentralized clinical pharmacist assigned to a surgical intensive care unit (ICU) documented all interventions made from mid-October 2003 through February 2004 using a standardized written form. The data were

retrospectively evaluated and the following information was extracted:

Results: A total of 129 interventions were documented over 4.5 months. The majority of interventions were identified during chart review (40%) and patient care rounds (39%). The potential cost avoidance of the documented interventions was \$205,919-\$280,421. Interventions identified during patient care rounds and chart reviews were most likely to achieve the greatest impact on cost avoidance. It was concluded that among the interventions performed and documented by a clinical pharmacist in an ICU, patient care rounds and chart-review activities were associated with the greatest number of interventions and the greatest potential cost avoidance.

A study was done by Schumock G.T et al titled-Economic Evaluations of Clinical Pharmacy Services—1988–1995<sup>[15]</sup>.

The objectives of this effort were to summarize and critique original economic assessments of clinical pharmacy services published from 1988–1995, and to make recommendations for future work in this area. A literature search was conducted to identify articles that were then blinded and randomly assigned to reviewers to confirm inclusion, abstract information, and assess the quality of study design. The 104 articles fell into four main categories based on type of service described: disease state management (4%), general pharmacotherapeutic monitoring (36%), pharmacokinetic monitoring services (13%), and targeted drug programs (47%). Articles were categorized by type of evaluation; 35% were considered outcome analyses, 32% outcome descriptions, and 18% full economic analyses. A majority (89%) of the studies reviewed described positive financial benefits from the clinical services evaluated; however, many (68%) did not include the input costs of providing the clinical service as part of the evaluation. Studies that were well conducted were most likely to demonstrate positive results. Commonly, results were expressed as net savings or costs avoided for a given time period or per patient. Seven studies expressed results as a benefit cost ratio (these ranged from 1.08:1 to 75.84:1, mean 16.70:1).

It was concluded that, overall this body of literature contains a wealth of information pertinent to the value of the clinical practice of pharmacy. Future economic evaluations of clinical pharmacy services should incorporate sound study design and evaluate practice in alternative settings.

In another study done by Dooley et al titled- A prospective multicentre study of pharmacist initiated changes to drug therapy and patient management in acute care government funded hospital.<sup>[16]</sup>The main aim of this study was to determine the cost savings of pharmacist initiated changes to hospitalized patients' drug therapy or management in eight major acute care government funded teaching hospitals in Australia.Reduction in LOS accounted for the majority of the savings measured. This is not surprising as increased LOS has been consistently associated with suboptimal medication use <sup>[2][7]</sup>) and a large proportion of the interventions were initiated to either reduce adverse events or increase treatment efficacy and were considered to have been of moderate or major clinical significance. Reducing LOS may result in increased patient throughput, which in turn could result in an overall increase in hospital expenditure. This could be one argument that these interventions would not result in savings that could be realized for the individual hospital overall. However, it

must be acknowledged that the expenditure on the individual patient would be less when interventions occurred. The hospital would save on these patients and in Australia further throughput activity would be balanced by case-based funding streams. Benefits of the interventions performed by pharmacists in this study not only include the savings associated with reducing the duration of hospitalization but also the associated positive outcome of the ability to treat more patients.

Over 10% of the interventions were deemed to have reduced the potential for readmission, and hence, significant costs were avoided. There were a range of different interventions that contributed to reducing potential for re-admission. These included, for example, initiation of prophylactic therapies (such as antibiotics), and instances where continuing therapy was not prescribed but the omission was detected by the pharmacist and therapy recommenced. A number of studies have shown that a large number of hospital admissions are due to adverse drug events, concordance problems, medication errors or suboptimal prescribing <sup>[17]</sup> This study supports the concept that clinical pharmacy services provided to admit patients reduced future healthcare costs.

There was little change in overall expenditure on drugs as a consequence of the interventions, as initiation of drug therapy occurred at a similar rate to cessation of existing therapy. Changes to drug therapy were primarily for clinical reasons and although in many cases involved the initiation of therapy with resultant increase in drug costs, a large number of cases were deemed to have resulted in reduction in LOS and/or reduced probability of readmission. In contrast, formulary restrictions, which contributed more so to reduced drug costs were very much secondary considerations. The clinical significance and the major impact on LOS and potential for readmission were reflective of the clinical focus and proactive nature of the interventions and demonstrate a quality use of medicines approach by the clinical pharmacy services provided. A similar finding was demonstrated in the ambulatory setting by Malone *et al* <sup>[18]</sup>. Studies that have demonstrated significant savings in drug costs by pharmacists have had a cost containment focus and have not independently quantified clinical and economic impact on other resources.<sup>[15]</sup> When annualized, the savings resulting from the interventions quantified at the eight sites was \$4 444 794

The magnitude of the savings determined in this study is comparable with those of other smaller published studies<sup>[19][20]</sup> and is demonstrated over a much larger and broader patient population. Additionally, in some of these studies the resources quantified also included physician and nursing time<sup>[19][20]</sup> Overall, this study has demonstrated a conclusion based on conservative assumptions with the actual savings likely to be significantly greater than those reported and quantified. It must be noted that the clinical activity of therapeutic interventions is an integral component of a clinical pharmacy service and cannot be effectively performed as an isolated activity.

This study clearly demonstrates that routine clinical pharmacist review of inpatient drug therapy is an essential component of the quality use of medicines with a significant potential to reduce LOS and potential for readmission.

A total of 1399 interventions were documented. Eight hundred and thirty-five interventions impacted on drug costs alone. Five hundred and eleven interventions were evaluated by

the independent panels with three quarters of these confirmed as having an impact on one or more of: length of stay, readmission probability, medical procedures or laboratory monitoring. There were 96 interventions deemed by the independent panels to have reduced LOS and 156 reduced the potential for readmission. The calculated savings was \$263 221 for the eight hospitals during the period of the study. This included \$150 307 for length of stay reduction, \$111 848 for readmission reduction.

The annualized cost savings relating to length of stay, readmission, drugs, medical procedures and laboratory monitoring as a result of clinical pharmacist initiated changes to hospitalized patient management or therapy was \$4 444 794 for eight major acute care government funded teaching hospitals in Australia.

### III. METHODOLOGY

- A cross-sectional study was conducted in Connaught Hospital, Freetown, Sierra Leone.
- Adapted validated observational instruments :
- Overhage *et al* an instrument for rating the value of pharmacists' clinical services
- Individualized Medication Assessment and Planning (Imap) tool: for rating the value of pharmacists clinical services and for assessing medication related problems and recommendations (interventions) - used to evaluate the severity of error, value of pharmaceutical care service; and to identify medication related problems

Between June and September 2016, patient files in 3 medical wards were assessed for drug therapy problems which were then documented. The information was analysed for potential clinical pharmacy interventions and the drug therapy problem leading to the need for such intervention identified and documented. The study was done prospectively but not in real time. That is it was done after the physician or medical officer had written on the files not necessarily before the prescription was written. Slightly adapted versions of two validated instruments was used –overhage *et al* Classification of Pharmacist intervention, an instrument for rating the value of Pharmacists clinical services and the Individualized Medication Assessment and Planning (Imap) tool, an instrument for assessing medication related problems and recommendations ( interventions). Basic patient demographics was documented.

The adapted instruments are included in the appendix section Patient age, sex and initial number of drugs at the beginning of admission were also noted.

An initial pilot study was carried out before the research started using 10 initial patients. This initial study was useful as it led to some important adjustments in the research instruments, which made it better suited for the research objective. These patients were not included in the final results.

Connaught Hospital being a 200 bed hospital, a convenience sample of 150 patient files was assessed

Inclusion criteria – In patients in medical wards.

Exclusion criteria – out-patients and surgical wards

The data was analysed using descriptive statistics – bar charts, pie charts, frequencies, tables and figures. , cross-tabulations

Patient Demographics to recorded included ,age ,sex ,number of drugs at admission ,nature of illness (acute/chronic/multiple chronic)

The overhage *et al* adapted version (adapted by Brian Thompson, 2016) classification for Pharmacist intervention was used to classify interventions. In the unadapted instrument interventions were classified from potentially lethal to serious ,Significant ,Minor , and no error but in the adapted instrument the classification was changed to potentially lethal , Serious , Relevant ,Minor and No error

Value of service in the original instrument (a validated tool known as (The Individualized medication assessment and planning tool) ranged from Extremely Significant, very significant, Significant, somewhat significant, no significance and adverse significance.

In the adapted instrument value of service ranged from extremely Important, Very Important, Important, Somewhat Important, Negligible Importance and No Importance

Implementation of recommendations were sub-divided into three parts –Implemented (that is fully implemented) ,partially implemented and not implemented.

The data obtained was analyzed and interpreted using descriptive statistics

- Of the 150 cases 77 had errors that were relevant, and 53% (80 of 150) of the services rendered were important.
- Medication related problems identified and recommendations were all shown:
- to have a potentially serious and positive impact on patient wellbeing and therapeutic outcomes
- as well as direct or indirect cost saving impact

Table 1 – Severity of error

TABLE 2 Percentage distribution of Value of Service

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Figure 1 - Percentage distribution of implementation of recommendations

Figure 2: Percentage distribution of age of patients

Table 3: Number of Drugs at Admission

NUMBER OF DRUGS AT ADMISSION			
		Frequency	Valid Percent
Valid	2	3	2
	3	20	13.4
	4	57	38.3
	5	35	23.5
	6	18	12.1
	7	10	6.7
	8	6	4

The most frequently occurring initial number of drugs on admission was 4 followed by 5 as the next highest

- In 13% of cases (20 of 150 patients, monitoring was needed to assess effectiveness of response to therapy and to assess for/prevent potential adverse effects
- In 5% of cases (8 of 150 patients) safer medication alternatives were considered necessary
- In 3% of cases (5 of 150 patients) one or more medication was considered not effective for the management of the disease condition.
- In 14% of cases (21 of 150 patients) there was no apparent reason for use of a medication
- In 37% of cases (56 of 150) there was a potential for drug interaction
- In 6% of cases (9 of 150), therapeutic duplication of medication was observed.
- In 1% percent of cases (2 of 150) presented with moderate adverse events, another one percent of cases presented with severe adverse events.
- In 51% of cases (77 of 150 patients) ,duration was not indicated
- In 1% of cases(2 of 150) medication was not available
- In 28% of cases (42 of 150) additional drugs were needed.
- In 22% of cases (33 of 150) it was considered necessary to discontinue drug
- In 47% of cases (71 of 150) it was considered necessary to monitor the patient closely
- In 4% of cases, it was considered necessary to recommend further lab tests
- It was clearly demonstrated that routine clinical pharmacist review of inpatient drug therapy is an essential component of the quality use of medicines with a significant potential to reduce LOS (length of stay) and potential for readmission.
- Reduction in LOS accounted for the majority of the savings measured. This is not surprising as increased LOS has been consistently associated with suboptimal medication use<sup>[2][7]</sup>

#### IV. DISCUSSION

It was clearly demonstrated in a prospective multicentre study<sup>[16]</sup> that routine clinical pharmacist review of inpatient drug therapy is an essential component of the quality use of medicines with a significant potential to reduce LOS (length of stay) and potential for readmission.

Reduction in LOS accounted for the majority of the savings measured. This is not surprising as increased LOS has been consistently associated with suboptimal medication use<sup>[2][7]</sup>

In a study titled economic effects of clinical pharmacy services<sup>[12]</sup> interventions reduced preventable adverse drug events and prescribing errors, thereby yielding savings related to cost avoidance.

The results of cost-benefit analysis suggested that general clinical pharmacy interventions are associated with cost savings. In this study the medication related problems identified and the recommendations maximized therapeutic outcomes which have been shown in all studies to reduce cost of care either directly or indirectly.

It can therefore be concluded that pharmaceutical care services will indirectly and even directly reduce cost and based on the analysis of severity of error and value of service ,there is a need for pharmaceutical care services and patient care will improve significantly when it is present

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# The Role of Citizen Journalism in Publicity of Terror attacks in Kenya

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**Abstract-** The study seeks to appraise the role of citizen journalism on publicity of terror attacks in Kenya in a bid to aid Africa in moving towards sustainable security and peace. It aims to achieve this by (1) Evaluating the role citizen journalists' play as victims in helping terrorists achieve publicity of terror in Kenya. (2) Assessing the role citizen journalist's play as bystanders in aiding terrorists attain publicity of terror in Kenya and finally, (3) Evaluating the role citizen journalists play as participatory journalists in helping terrorists achieve publicity of terror in Kenya. The study reviewed literature on three major terrorist attacks in Kenya that have happened between 1998 and 2015. In view of the background and literature review, it was established that citizen journalism plays a key role in ensuring that terrorists receive the required attention to pursue their much coveted publicity hence achieving their goals. Also, attributes of citizen journalists as victims, bystanders and participatory journalists all work together for the benefit of terrorist's publicity in Kenya. The study concluded that, the interplay and harmony of these aspects ensure persuasive publicity is given to terrorists hence helping them achieve their objectives of terrorism. Therefore, there is need to ensure that proper policies and strategies are employed by the communication authority of Kenya and the communication companies to curtail the publicity given to terror attacks by citizen journalists. This will be a step towards achieving sustainable security and peace in Africa.

**Index Terms-** Citizen Journalism, publicity, terror attacks

## I. INTRODUCTION

While the intentions of terrorists differ greatly, every terrorist group is connected to each other by one major norm which is the desire to convey their message to as many people as they can. Their major aim is to maximize publicity for their basis. The concept of new and dangerous terrorism manifested itself after the 9/11 attack on America's soil. Various scholars agreed to the fact that this present-day threat was serious and real. Others indicated that it was not the terror attacks which had gained momentum, but rather, the setting in which the terrorism functioned had taken a different direction. The advancement in information technology and communication has worked as oxygen for terrorists' publicity (Spencer 2006; Nacos 2007b). Cohen (2008) indicates that, whether the contemporary attacks are dangerous or not, publicity is always key for terrorism. DE Graaf and Schmid (1982) further note that, an act of terrorism in authenticity is usually an act of communication as the victims are always used as instruments to propagate the impact.

In essence, access to media is vital for terrorist attacks as their violence, demands or threats to violence will have no meaning if such communication does not reach the greater number of people. Renowned terrorist groups have an easy time disseminating their messages around the world by use of the new forms of communication through the internet. Citizen journalism has been regarded as a recognized way to relate proceedings of terror attacks, to the conventional media-consuming public (Nacos 2016). Citizens involvement in the media is a developing phenomenon whose benefits include audiences witnessing events posting eyewitness versions on the internet instantly or sending these photos and accounts to the media. The result of this is how different states and governments respond. Terrorists' goal is for governments and their societies to overreact and impose great costs on anyone one who cares to listen (Lawrence 2005). Eventually, those who perform acts of terrorism and those who disseminate these acts are presumed to be working in "unison". This study seeks to investigate the role of citizen journalism propelling publicity of terror attacks in Kenya.

## Citizen Journalism

The term citizen journalism was non-existent before the initiation of the Internet. This term grew in tandem with the development of the interactive roles on the Internet. Citizen journalism comprises many features and comes in various forms such as uploading photographs or videos to the media, blogs and forums (Lieb, 2009). The concept behind citizen journalism is that, persons with lack of professional training in journalism can utilize the tools of modern information technology to create content and distribute globally.

In the circumstance of citizen journalist covering scenes of terrorist attack, every single person can become involved from a number of diverse angles. These angles include; as a casualty caught up in the incident, secondly, as an eyewitness who is in the "right place" at the "optimal time", thirdly, as a person who makes way to the scene for the purposes of covering the event or fourthly, as a participatory citizen journalist, who contributes to what is being discussed online regarding the attack (Deuze, Bruns, Neuberger 2007). Even though this kind of journalists may lack proper training, they usually possess ample zeal whose impact could work like a double-edged sword; causing positive or negative results. But, in this context, the impact is usually terrible as it boosts publicity for terror attacks.

## Terror Attacks in Kenya

Terror attacks popularly known as Terrorism are well-defined as forms of violence directed against defenseless civilians with the goal of attaining a religious and/or political objectives. The crucial aim that terrorists seek to achieve is to

create and maintain an atmosphere of anxiety and fear among the people where they carry out the attacks (Judith 2014). The focus of this study is in Kenya, where five major attacks have been carried out which shook the country (Samuel 2013). This was publicized mostly by citizen journalists who were at various angles and conveyed the traumatic messages widely. The attacks include among many others, The United States Embassy bombing in 1998 where 213 people were killed, the Kikambala Hotel bombing in 2002 where 13 people were killed, the West Gate mall attack in 2013 where at least 67 people were killed, the Mpeketoni attack in 2014 where more than 60 people were killed and the Garissa University attack in 2015 where approximately 150 people perished. This study seeks to establish the role played by citizen journalists in the publicity of three terror attacks among the five witnessed in Kenya. The study analyzed the role played by citizen journalists in the US- Embassy bombing attack in Kenya in 1998, the West-gate mall attack in 2013 and the Garissa university attack in 2015 in a bid to evaluate the intensity of the news on air during the different periods.

### Problem Statement

Due to the immense effects of terrorism on people, media finds it as newsworthy to air everything that is happening. Consciously or unconsciously, the media gives terror perpetrators the oxygen of publicity which they thrive wholeheartedly as this is usually their main goal- spread of fear! Nonetheless, conventional mainstream media have the famous gate-keeping rules which guide the gathering and dissemination of news to the public. Such policies aid in shielding the public from real-time horror attacks to the victims. However, with the advent of internet, a new group of journalists popularly referred to as "Citizen Journalists" came into space. Citizen journalism means that there is no control whatsoever of what the public will be treated to in terms of news. Any kind of information, videos and photos will find their way into the public space (Jarvis 2004). The critical importance of this group of journalists is basically at the early phases of an attack when the news is being broken to the public, which is usually done by the victims caught up in the attack. However, citizen journalists are a weak group, due to their contiguity to a risk event. Therefore, they will try to seek sympathy by all means hence giving the terrorist group a big mileage in terms of publicity. This study seeks to establish the role of citizen journalists in boosting publicity of terror particularly in their pursuit to spread terror and inspire the atmosphere of distress and anguish. This coverage of terrorist activities particularly unfiltered events by the practicing citizen journalism intensifies the spread of fear to the masses. The investigation will highlight reasons why it is important to have policies that control those who spread such images, thus aggravating the already awful actions. The ultimate question being examined therefore is, what is the role of citizen journalists, who give the oxygen of publicity to terrorist?

### 1.2 Objectives

The Study had three objectives

1. To evaluate the role of Victims as citizen journalists in helping terrorists achieve publicity of terror in Kenya
2. To assess the role of bystanders as citizen journalists in aiding terrorists attain publicity of terror in Kenya

3. To establish the role of participatory journalism in helping terrorists achieve publicity of terror in Kenya

## II. THEORETICAL BACKGROUND (LITERATURE REVIEW)

### 2.1 Victims as Citizen Journalists in helping terrorists achieve publicity in Kenya

Every journalists' dream is to cover a story as it unfolds. It is usually like a race against time as that is what gives them or their media house mileage. However, covering disasters like Tsunamis, earthquakes and terrorist attacks might not be that rosy as these are events of great magnitude and risk, additionally, it's a fact and given that journalists will not always be present when such disasters strike (Gillmor, 2008). Therefore, the professional journalists will always look for images, videos and eye witness accounts, piece them together and send out to inform the world of what is happening.

Victims of terror attacks have played the role of citizen journalists in helping propagate publicity for terrorism in Kenya and around the world quite well. The new pattern of terrorism is somewhat a consequence of a sudden advancement of information technology, which is predominantly demonstrated in the fact that terrorist organisations need mass media to accomplish their aims (Valenzuela and Zuniga 2010). In Kenya, the three worst terrorist attacks (The United States Embassy-Nairobi bombing in 1998, the West gate mall attack and the Garissa University attack) that have occurred spread quite fast due to the ability of the victims to send out images and videos in a bid to seek sympathy. However, The United States Embassy-Nairobi bombing was communicated differently as compared to the West gate mall attack and the Garissa University. News of the US-embassy blast reached masses outside Nairobi through a state owned television (KBC) hours later (Claiborne 1998). According to Njenga, Nyamai and Kigamwa (2003), the public saw the horrendous news of the US-embassy on state-owned TV, while many more heard about it on the state-owned radio. Others read about it in the press later the same day. This is a clear indication that news to the public in 1998 followed a certain path before it went out. Victims during the 1998 US-Embassy bomb blast had no means of sending out the horrible photos and videos of events unfolding. The most likely reason is that social media was not common then, and rules were stringent from the government. Burke (2000), indicates that, Once Al-Qaida was established by Bin Laden and a couple other veteran radicals in 1988, mass communication around most third world countries and beyond were still controlled by large corporations and States. In Kenya, during that period (1998) Social media had not been introduced and most of the media houses were state owned (Kadhi & Kutten 2006). The two scholars further indicate that during the 1998 bomb-blast, the Kenyan media had the following characteristics which hindered the victims from communicating; incomplete liberalization of the broadcasting sector where by, only Kenya Broadcasting Corporation (KBC) was allowed to broadcast, and secondly, there was inadequate press coverage hence lack of correspondents plus great levels of internet illiteracy amongst the public. All these worked against the vibrant communication by the victims regarding the 1998 bomb-blast in Nairobi. Therefore, the ultimate goal of the Al-

Qaida terror attack was not achieved much since Victims were not in a position to spread the fear.

However, in the 2013 Westgate mall attack in Kenya, things were totally different, due to the advent of social media. According to Thotho (2010), Facebook was formed in 2004 and towards 2007, it already had 21 million registered users creating approximately 1.6 billion page views daily around the world. Kenya is among the countries that has liberated communication and mass communication is quite popular. Social media was a perfect platform for terrorists who got “oxygen” from the victims of the 2013 terror attack. Apart from Facebook, twitter and Instagram worked concurrently in making victims of the attack pass the terror messages fast and wide. Before the mainstream media got to know what was happening, victims of the attack were populating the social media with horror messages. These gave the terror group mileage in terms of their goal. Below are some excerpts from victims which got the world shaken about the 2013 attack at Westgate mall.

**@Thumbelinarh;** *Alot of GUNFIRE, AT WESTGATE!!! Where's the police???*

*Something really bad goin on at #Westgate.Gunshots!!!! Everyone's fled.*

**@Ally\_McMimz;** *Shooting is still going on. Does anyone know if police are here? Were scared*

**Shirley (@Shirley Ghetto:** *“I'm under the mattresses!!!!!! This might be my last tweet #Westgate mall. :( :”(*

*“I don't care anymore. If they shoot let them come shoot. It doesn't even seem like we'll make it out anyway #Westgate”*

*“The cop who tried to save us, Thank you. I hope they didn't kill him.”*

*Guyyys!!!!!!!!!!!!!! They found me!!!!!!!!!!!! #Westgate gejh&\$60-\$\*E*

**KamalKaur(@kamz26):** *“Crying. And praying. I lay in a pool of someone's blood, a dead little boy lying on my side. Trying to call for help, keeping others calm. ”Please tell me if everyone is out of the mall. Please. I can't stop crying. ”My Ruhila is gone...”*

*“The one guy I saw had magazines of bullets attached everywhere on him. Big gun that showered bullets. Randomly shooting at people. And kids.”*

*“Images of the day keep flashing in front of my eyes. Dead bodies, injured people, wailing, crying, scared.”*

When the public is treated to such messages from victims, a crop of fear engulfs everyone and one gets the whole picture of the kind of terror that is taking place. This makes the terror group achieve their goal. Burke (2010) indicates that, the relationship between the media and terrorism is clear. Terrorists' purpose is to aggravate irrational fear among great numbers of people so as to influence policymakers hence advance their goals. Deprived of the media, very few people would know of an attack that has taken place. Similarly, without democracy, those exercising power would have little or no reason to care about the opinions that such violence provokes (Hoffman, & McCormick 2004).

In the Garissa university attack, the same thing happened. The victims of the terror attack were first to break the news to the whole world through social media. The attack, considered as the second most horrible attack in Kenya since the 1998 U.S.

embassy bombing in Nairobi, caught everyone by surprise. Most media houses had no clue of the attack until a victim through social media broke the news (Osman 2015). The victim known as Abdicator Musa, wrote on his Facebook account *“We are under attack. Pray for us.”* Shortly after, several other victims spread the horrific news through twitter and Facebook. Some excerpts are as below;

**Alinoor (B) Moulid @AlinoorMB;** *#BREAKING: Students who escaped report that at least 5 armed men stormed facility at dawn & started their killing from masjid & boarding area*

**AugustineAlanga @AugustineAlanga;** *we have been chased out of Garissa university college early this morning by unknown attackers.*

**HannahMcNeish @HannahMcNeish;** *#GarissaAttack survivor tells @GabeJoselow her friends are inside "being held hostage & the policemen are outside"*

Given the instantaneous nature of social media, the broadcast of the attack spread fast! The mainstream media in Kenya were caught by surprise as they were on their daily predictable content of the morning shows when an update of the attack was trending on twitter. Therefore, if Victims did not mention about the attack, very few people around the world including Kenyans would know about it. According to Osman (2015), most Kenyans assumed that this was a small attack and the security personnel in Garissa would handle only to realize through social media bloggers, who spoke to victims inside the university, that the situation was dire. The bloggers gave detailed reports and pictures of how cruel the gunmen were. The whole world was in shock, as the Guardian newspaper reported comments from one of the victims (3<sup>rd</sup> April 2015) *“Kenya attack: There were screams and nobody knew if we would survive”*.

## 2.2 Bystanders as Citizen Journalists in aiding terrorists attain publicity of terror in Kenya

Digital technologies such as blogs, the web, camera phones and digital cameras have developed to the level where people on the scene also known as the bystanders have the ability to reach an extensive audience, to show and tell the world what they witnessed and experienced (Lieb 2009). A few years back, photographs and videos from eyewitnesses turned up for widespread broadcasting only on newspapers and on news programs. Today, through blogs, twitter, Facebook and Instagram among others, amateur news spreads rapidly and efficiently, often finding huge audiences without the help or need of the mainstream news outlets.

By the mere fact that bystanders are always at the “right place” at the “right time”, it is usually quite convenient for them to spread the eye witness messages to the wider population without knowledge of their contribution to the publicity of terror which terror groups aim to achieve. According to Deuze (2009), bystanders always give first hand contribution during crisis events which has no gatekeepers hence ensures that extremists groups have a voice. Most often than not, they usually exaggerate the information since they are neither victims nor professional journalists. Their messages work best for the publicity of terror. The messages from bystanders could be deceitful and subjective (Nacos 2002). Due to the excitement of witnessing terror crises,

the messages could worsen the situation at hand hence alleviate the terror groups' goals. Bystanders are untrained to view events cynically and try to put them in context the way qualified journalists do (Rohner & Frey 2007). Hence, it is very difficult for news organizations or the public to know if the photos are trustworthy or not. Meanwhile, the terror groups are receiving publicity. In Kenya, the three terror attacks received different publicities from the bystanders. The US- Embassy bombing in 1998 did not achieve much publicity from the bystanders since there was lack of internet during that time. However, the 2013 Westgate mall attack was over publicized by the bystanders. A few excerpts and photos from the bystanders are as shown below:

**@TylerHicks**

*"Al-Shabaab militants remain inside Westgate mall with hostages Sun am"*

*Witness to a massacre in a Nairobi mall*



Photos courtesy of: <https://www.tweetsfromwitnessesofwestgatemallattack&rlz=1C1CHBD>

When such photos hit the social media platform, they spread like fire hence terrorists enjoy the publicity. On the other hand, the Garissa university attackers received almost the same privilege of publicity through bystanders. Some of the excerpts on social media were as follows:

**Sam Piranty** ✓ **@sampiranty**

*Garissa Uni eyewitness says 'they were shooting randomly... they were not selecting buy gender' #GarissaAttack*

*10:20 AM - 2 Apr 2015*



**DennisOkari** ✓ **@DennisOkari**

*Just been told to take cover outside the University. I can hear heavy gunfire & explosions. Hundredsof students run out, some crawling.*

*1:18 PM - 2 Apr 2015*

**Ahmed Mohamed** **@Asmali77**

*A nurse at the Garissa General Hospital tells me that the hospital is overwhelmed, requests for blood donations. #GarissaAttack*

*9:42 AM - 2 Apr 2015 · Nairobi, Kenya*

Hoffman (2003) indicates that, if the main resolve of terrorism is to appeal to the public, create mass fear and hysteria, then social media is exactly what terrorists are looking for to promote their agenda. The Bystanders during the 2013 Westgate mall attack and 2015 Garissa university attack gave terrorism ample publicity. Quotes such as "Several hours after the standoff began, Somali jihadist group Al Shabaab claimed responsibility for the attack, saying they are at war with Kenya" were seen on media.

### 2.3 Participatory Journalism in helping Terrorists achieve Publicity of Terror in Kenya

Participatory journalism or what is popularly known as networked journalism involves collaborative nature of journalism (Jarvis 2006). This collaborative nature allows amateurs and professional journalists to work together to get the actual story by linking information to each other across products and to share ideas, questions, facts, answers, and perspectives. Journalists tussle with the hurrying pace of the news sequence and the complex and diverse nature of terrorism. Particularly, in the event of breaking news, they have to adjust to the complexity and speed of the information streams that are gradually influenced by the digital platforms and the terrorists themselves as well. Therefore, according to Meikle (2002) an embrace of participatory journalism by professional journalists challenges media organizations to encompass the level of their direct contact with audiences as contributors in the processes of collecting, selecting, editing, generating, and communicating news.

One key focus of participatory journalism is opinion. There are several blogs and forums where viewers and listeners analyze, discuss and do "post mortem" of events appearing in the media, or debate events as they unfold. Some of them are indiscriminate, but others steadily perform these roles and articulate issues in a synthesized way (Gillmor 2009). In Kenya, during the West gate Mall attack in 2013 and Garissa University attack in 2015, participatory journalists gave ample publicity to terrorists. This is because, at the hit of the attack, media houses had no idea of what was happening while social media had already published the news (Osman 2015). Therefore, media houses had to solicit news from citizens through participatory journalism. As indicated below, various media houses and government offices used content from citizen journalists to buffer what they were reporting:

**reported.ly** ✓ **@reportedly**

*Eyewitnesses per @daily nation: 8 bodies received at Garissa Hospital mortuary #GarissaAttack <http://bit.ly/INCTkJ>*

*12:00 PM - 2 Apr 2015*

**ktn** ✓ **@KTNKenya**

*Nkaiisery: We lost one KDF officer, one policeman and two guards #Campus Siege9:19 PM - 2 Apr 2015*

**Nation FM** ✓ @NationFMKe

*Heavy gunfire as @kdfinfo soldiers fight to smoke out #GarissaUni hostage takers.1:21 PM - 2 Apr 2015 · Kenya*

**InteriorCNG Ministry** ✓ @InteriorKE

*#GarissaAttack Update: Of the four hostels, 3 have been evacuated. The attackers have been cornered in one hostel & the operations continue.11:05 AM - 2 Apr 2015*

**MaryHarper** ✓ @mary\_harper

*#AlShabaab told me it entered university in #Garissa at 3am, separating Muslims from non-Muslims. #GarissaAttack12:19 PM - 2 Apr 2015*

Such information would be aired by most media houses and press as received from eye witnesses and victims. The danger is that, these kind of news coverage provided the publicity which terrorists were really looking for, plus add misinformation through poor confirmation and lack of background. Such publicity could be mistaken for helping terrorists increase their power and make their enrolment more effective (Mohammed 2016)

Participatory journalism amplifies the communicative level and impact of terrorism, while adding to the fabrication and emotional responses to terror incidents. Participatory journalism has changed the nature of news concerning terror, by providing eyewitness accounts, images and live video. This kind of journalism has transformed news but there are still policy problems in terms of news judgement and verification. This has allowed a lot of publicity of terror through citizen journalism.

### III. METHODOLOGY

This study was based on literature review related to Citizen Journalism and publicity of terror attacks. It evaluated the role of victims as citizen journalists in helping terrorists achieve publicity of terror in Kenya, secondly, it assessed the role of bystanders as citizen journalists in aiding terrorists attain publicity of terror in Kenya and finally, it established the role of participatory journalism in helping terrorists achieve publicity of terror in Kenya.

### IV. CONCLUSION

The study established the following conclusions based on literature reviewed. The technology companies that offer platforms for citizens and the general public plus journalists to disseminate and discuss terrorism must work harder to filter and improve how they dispense information. The same way media

houses have to accept a wider accountability for effects of reporting on terrorism, the digital companies must also recognize that they are part of the formation of narratives and public opinion.

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# Tracing the History, Heritage and Scenic Beauties of Martand and Chatbal Destinations in Twin Parganas of Mattan And Kuthar

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**Abstract-** Martand site is very popular throughout the world. It can also guide the further growth of tourism in district Anantnag very easily. It has a potential to contribute a big share in promoting heritage tourism of the valley. The people who visit this site feel an aesthetic pleasure. Some tourists have been asking for archeological guidebooks, photo cards of this monument. This paper tries to trace out the historical background and heritage attractions of Martand site and also it tries to place Chatbal as nascent picnic attraction for tourists to enjoy hustle free vacations at this virgin spot which has emerged as mini-phalgam in Pargana Kuthar. The scenic land of Chatbal is located on the remote corner of the east of the Pargana Kuthar. Moments after stepping into the land of Chatbal, tourists will definitely fall in love with the striking beauty of the place. The best way to explore the town of Chatbal is to take nature walks and experience a strange yet pleasurable kind of closeness to the lofty mountains, lush green surroundings and the sound of streams running down the rugged body of mountains. For people looking out for some adventure, Chatbal offers thrilling trekking routes as well. So this study is an effort to highlight the potential products for tourism in twin Parganas like Kuthar and Mattan.

**Index Terms-** Pargana Kuthar and Mattan, Martand, Chatbal, Heritage, Tourism, Rural, Eco- Tourism.

## I. INTRODUCTION

Pargana Kuthar is located in the south-east of district Anantnag. It comprises of a cluster of villages on its north, south, east and west. The area features hillside villages and also the villages lying in lower plains. It was one the Parganas of Kashmir in Mughal period.<sup>1</sup> The Kuthar valley is very rich in terms of its scenic beauty and archaeological wealth. Although it has already been explored, scope for further exploration still remains there. Mattan Pargana is situated at the North- Western boundary of the Kuthar Pargana. It is on the top of the lofty plateau, at whose feet stretch the broad green plains of Mattan and Kuthar valley.<sup>2</sup> It is surrounded on every side by mountains

into which there are numerous inlets forming straths<sup>3</sup> on a level with the plain, but all having a lofty pass at their upper extremity.<sup>4</sup> The north area above the Anantnag town is Bawn. Nilmatpurana locates the *Gautamanaga*, named by the name of *Martandamahatmya*.<sup>5</sup> Both Parganas (Mattan and Kuthar) presents its salubrious and invigorating climate during the summer season due to their close association with lush green forests and towering mountains. Study over the area reveals that apart from heritage tourism, it can easily promote eco-tourism<sup>6</sup> because most of the historic or religious or scenic sites in the area are sandwiched in between the forests and lush green fields. Here the focus of the study is Chatbal and Martand site in twin Parganas of Mattan and Kuthar. Chatbal is all winded with high and low Range Mountains from all sides and silently presents a beautiful experience same is true with the historical heritage of Martand which has been identified as site of attraction for bollywood shootings popular Hyder movie was also picturized here.

<sup>3</sup> A wide, Flat River Valley

<sup>4</sup> Vinge, G.T. 1842. *Travels in Kashmir, Ladak, Iskardo*, Vol. I, London: Henry Colburn, Publisher, Great Marlborough Street p.283.

<sup>5</sup> Stein.M.A.2005. *Ancient Geography of Kasmir*, Srinagar: Gulshan Books, p.178.

<sup>6</sup> Panda.Tapan. K.2004. *Tourism Management, Socio Economic and Ecological Perspective* (Hyderabad: University Press. p. 20. Eco tourism is a form of tourism involving to visit fragile, pristine and relatively undisturbed natural areas, intended as a low impact often small scale alternative to standard commercial (mass) tourism eco-tourism focuses on socially responsible travel, personal growth and environmental sustainability (for detailed information see *Rural Tourism Development: An overview of Tourism in the TipumPhakey village of Naharkata in Dibrugarh District, Assam(India)* by NitashreeMili, *International Journal of Scientific and Research Publications* 2(12), Dec.2012.

<sup>1</sup> Majboor. Arjun. Dev. 2001-2. Section iv-Some Memorable Shrines in Districts –The forgottenTirthas in Shambles. *Vitasta* Annual no. vol. xxxv p.180.

<sup>2</sup> Kak, R.C, *Ancient Monuments of Kashmir*, p.131.

## II. DISCUSSING THE HISTORY OF MARTAND (SUN TEMPLE) AND SCENIC CHARM OF CHATBAL

**MARTAND:**-The temple of Martand is situated at a distance of 5 miles away from Anantnag.<sup>7</sup> In order to reach Martand temple one has to go 2 kilometers up from the Mattan to reach Ranbirpora Village on the Mattan *Karewa* (Plateau). It has latitude of 33°45' and a longitude of 75°16'. It is at an elevation of 5,817 feet from the sea level.<sup>8</sup> According to local legend, Surya, the sun god of Hindu mythology was born of Aditi from a lifeless egg called Martanda. Aditi was the wife of Kashyap, the saint from whom Kashmir probably takes its name. Surya was her thirteenth child. The spring of Mattan is attributed to this legend. Lord Vishnu-Surya has been worshiped in his Martanda manifestation. The modern name of the Mattan seems to have been evolved from the Sanskrit Martanda (*Mart* =dead/ and < --- *anda*= egg) with the passage of time.<sup>9</sup>

Vinge mentions in his account that it is said that Kashyap Rishi after his desiccation work walked about in the greatest delight; that he accidentally found an egg (the mundane egg of the Hindus) shining most brilliantly, which he picked up. It broke in his hand, and from it flowed the springs of Bawan or Maha-Martand.<sup>10</sup>

Kalhana has given contradictory reference regarding the founder of Martanda for example at one place he has mentioned that king Ranaditya founded Martand.<sup>11</sup> And in another book he has mentioned the famous warrior king Lalita Ditya Muktapida.<sup>12</sup> The king appeared to be a worshiper of sun as an all pervading phenomenon.<sup>13</sup> He defeated the Yashovarman the king of

Kanauj.<sup>14</sup> So his power and valour naturally would have made him Lalitaditya Muktapida (Swelled with pride) and he paid homage to the fierce luminary by founding Martanda.<sup>15</sup> Walter Lawrance is of the view that the temple structure must have been started somewhere between 370 to 500 A.D. and completed during the reign of Lalitaditya Muktapida.<sup>16</sup> General Cunningham, however, on the strength of a passage in the *Rajtarangini* ascribes the building of the temple to Ranaditya, who reigned from A.D. 578 to 594. Hasan recognizes it with the name of *Martandashwar* and referred that it was built by Raja Ram Dev on Mattan *Karewa* in year 95 *Kaljugi*.<sup>17</sup> He also mentions that Martand temple was repaired with fair amount of money by Raja Lalitaditya during his rule and was adorned with gold.<sup>18</sup> Mr. Fergusson, nevertheless, doubts the correctness of this opinion and does not consider it to be clear that it is dedicated to the sun. He also thinks that it was probably built about 100 years after the temple at Awantipora, about A.D. 852 or 853.<sup>19</sup> According to Stien the Martanda temple was built along with its enclosure wall by Lalitaditya Muktapida. Stein's view has been accepted practically by all scholars.<sup>20</sup>

It occupies undoubtedly the finest position in Kashmir. This noble ruin is most striking in size and situation of all the existing remains of Kashmir Grandeur.<sup>21</sup> The solid walls and bold outlines towering over the fluted pillars of the surrounding

<sup>7</sup> Kak, R.C. op ct, p.131.

<sup>8</sup> Bates.2005. *A Gazetteer of Kashmir*, Gulshan Books, p.270.

<sup>9</sup> <https://www.sikhiwiki.org/index.php/martand-temple>

<sup>10</sup> Vinge, G.T. 1842. *Travels in Kashmir, Ladak, Iskardo*, Vol. I, p.359. (Two perennial bubbling springs gush out from its toe with equal volume of water at bawan and Anantanag. Along the toe of matan karewa, towards Mattan, Pehroo and Kanganhal viillage, one can notice clearly the pebble-beds and layers of shingle, about which some Geologists, believe that these are obvious beach-marks or shore-margin deposits of former Kashmirian lake satisar, as the tides of vast water body area besides hawing its shore are held mainly responsible for such deposits. See Atta Mohammad Mir. 2013. *Kashmir Dells and Dales*, Srinagar: Gulshan Books, p.41.)

<sup>11</sup> Stein, *Kalhana's Rajtarangini*, vol-I, p.141. (Ferguson mentions "actually recent excavations has shown that an older temple was incorporated into the new one. It is thought that the old temple was work of king Ranaditya a few centuries earlier. See... James, p. Ferguson. 2009. *Kashmir- A Historical Introduction*, City Book Centre, p.113)

<sup>12</sup> Ibid, p.466.

<sup>13</sup> The worship of the sun seems to have been brought into Kashmir by the Kushans, probably from Iran, as we have the evidence of its early introduction from the Rajatangani which mentions the building of a temple to the sun-god by king Ranaditya. Bamzai.P.N.K. 2008. *A History of Kashmir Political- Social- Cultural*, Gulshan books, p.199.

<sup>14</sup> *Kalhana's Rajtarangini*, vol-I, p.132-133. (See also *Early History of India* by V.A. Smith, 3<sup>rd</sup> edition, 1914, p.372 and "Unsung Heroes 3: Lalitaditya", 23 Dec, 2014, <http://.ariseindiaforum.org> (*AriseIndia Forum*),

<sup>15</sup> Sri Sathya Sai Bal Vikas, Jan 2012.

<sup>16</sup> Lawrence, *Valley of Kashmir*, p.171. (Cunningham attributed the central edifice to King Ranaditya and to his precedessors and the colonnade to lalitaditya Muktapida. The two annexes on the north and south of the mandapa were built by Ranaditya and his queen Amritaprabha. – See Agrawal, R.C. 1998. *Kashmir and its Monumental Glory*, New Delhi: Aryan Books International, p.136)

<sup>17</sup> Khuihami, H.S. *Tarikh Hassan*, vol-I, p.266. (According to Hassan, there was a town named Babul in the *Karewas* of South Kashmir built by Raja Ram Deva ( Ranaditya). In front of his royal palace he built Martandeshwara temple. Khuihami, H.S. *Tarikh Hassan*, vol-I, Eng Trans. by A.R khand.70.

<sup>18</sup> Ibid, vol-I, p-267.

<sup>19</sup> Collet, J. 2014. *A guide for visitors*, Srinagar: Jay Kay Books, p.126. (A.C Arora highlights that this temple was built by Hindu king in the 5<sup>th</sup> century and modified and repaired by king Lalitaditya in the 8<sup>th</sup> century. For details see ...A.C. Arora. 2005. *Kashmir the Land of Celestial charms*, Gulshan Books, p.82.

<sup>20</sup> Agrawal, R.C. *Kashmir and its Monumental Glory*, p.136.

<sup>21</sup> The Kashmiris excelled in architecture during the period ending the 12<sup>th</sup> century A.D. the archaeological remains at Awantipora, Martand, Taper, Mattan and Prihaspur are most remarkable existing monuments in. Kashmir... This splendid Architecture of Kashmir is our most treasured heritage. (Hassanian, Fida Mohammad Khan.2012. *Historic Kashmir*, Gulshan Books, p.10.

colonnade give it almost an imposing appearance.<sup>22</sup> It is usually called the "House of the Pandus" by the Hindus and by the local populace.<sup>23</sup> The temple of Martanda is dedicated to Vishnu in his incarnation as the sun.<sup>24</sup> It is also marked by a magnificent spring (traditionally represented as two, *Vimala* and *Kamala*) which in ancient legend connects with the birth of sun god Martanda.<sup>25</sup> There is an interesting reference that king Kalasha (1063-89)<sup>26</sup> of Lohara dynasty went to pray Martanda and to find peace.<sup>27</sup> In his last being ill and filled with remorse for his past deeds, he went to the temple of Martanda where he offered a gold image of the 'God' for prolongation of his life.<sup>28</sup> He was a follower of Shivism<sup>29</sup> and thus finally breathed his last at the feet of Sacred temple of Martand in 1089 A.D.<sup>30</sup> Hashra his son, respected this temple in the course of the ruthless confiscation to which he subjected the other rich shrines of the country.<sup>31</sup> Kalhana praises "the wonderful shrine of Martanda with its massive walls of stone, within a lofty enclosure".<sup>32</sup> It ruins still the most impressive specimen of ancient Kashmir architecture. Kalhana distinctly mentions the town "swelling with grapes" which Lalitaditya founded near his temple.<sup>33</sup> But no trace remains now. It is probable that a canal then supplied water from the Lidar to the naturally arid plateau on which the temple stands.<sup>34</sup> This canal seems to have been repaired by Zainul-Abidin whose irrigation works on the Martand are described at length by Jonaraja.<sup>35</sup>

It is referred as *Martandesa* by Jonaraja.<sup>36</sup> Abul Fazal notices the large temple of Matan and the well or pit close by which a Muhammadan legend represents as a place of captivity of the angles Harut and Marut.<sup>37</sup>

<sup>22</sup>Bates, A Gazetteer of Kashmir, p.270.

<sup>23</sup>Ibid. p. 270.

<sup>24</sup>Ferguson. 2009. *Kashmir- A Historical Introduction*, City Book Centre, p.113.

<sup>25</sup>Kalhans.*Rajtarangini*, p.465.

<sup>26</sup> Agrawal, R.C. *Kashmir and its Monumental Glory*, p.136.

<sup>27</sup>Kalhans.*Rajtarangini*, p.466.

<sup>28</sup> Agrawal, R.C. p.136.

<sup>29</sup> Kalhans.*Rajtarangini* p.324.

<sup>30</sup> Ibid.p.325.

<sup>31</sup> Ibid. p.466.

<sup>32</sup> Ibid.

<sup>33</sup> Ibid.

<sup>34</sup> Ibid.

<sup>35</sup> Agarwal, p.138.

<sup>36</sup> Kalhans.*Rajtarangini* p.466.

<sup>37</sup>Ibid. p.466. (On the northern side of the temple, at the distance of 150 yards, stand a few apricot trees, and the residence of a Mojavar, or fakir, whose province is to superintend the existence of a well called the Chah-i- Babul, or well of Harut-Marut. Vinge believed that it was very deep and very old, having been dug long before the time of the Moguls. Harut and Marut were two angels. According to local Musalmans they were sent downwards from Almighty for the purpose of improving them the people of area. But having descended accidentally upon the house of a courtesan, they were surprised into an unhallowed liking for the society, and neglected the work of reformation to which they were appointed. Thus they were, therefore, punished by being shut

Francis Younghusband in his book *Kashmir* adds;

*Of all the ruins in Kashmir the Martand ruins are both the most remarkable and the most characteristic. No temple was ever built on a finer site. It stands on an open plain, where it can be seen to full advantage. Behind it rises a range of Snowy mountains...It is one the most heavenly spots on earth...The temple of Martand is the finest example of what is known as the Kashmirian style of architecture,<sup>38</sup> and was built by the most noted of the Kashmir king, Lalitaditya, who reigned between the years 699 and 736 A.D.<sup>39</sup>*

It can be considered either a representative of all such great buildings and monuments or a combination and sum total of all the qualities. It gives an insight into the greatness of the people of Kashmir.<sup>40</sup> In terms of beauty and strength and in grandeur it is next to Egypt and Greece.<sup>41</sup> This temple has been built with strong and square limestone. The temple has been built with strong and square pattern. It is now in ruins and there are many such ruins scattered. Anyone bereft of the love of nature could select such a special spot for the construction of the temple.

G.T. Vinge in his *Travels In Kashmir, Ladak, Iskardo*, defines the Martand in the following lines;

*As an isolated ruin, this deserves, on account of its solitary and massive grandeur, to be ranked, not only as the first ruin of the kind in Kashmir, but as one of the noblest amongst the architectural relics of antiquity that are to be seen in any country. Its noble and exposed situation at the foot of the hills reminded me of that of the Escorial.<sup>42</sup> It has no forest of cork-trees and evergreen oaks before it, nor is it to be compared in point of size to that stupendous building, but it is visible from a*

up in a well; and the Kashmiri as say that the Chah-i-Babul is the place of their imprisonment.... See vinge p. 361.

<sup>38</sup>It is however, decidedly Hindu and not either Buddhist or Jain, while, the sculptures show, according to Marshall, a close connection with the typical Hindu work of the late Gupta period. This great temple of the sun at Martand became the model for all subsequent Brahmanical temples in Kashmir. See Sufi, G.M.D. 1996. *Kashir - Being a History of Kashmir*, vol. I, New Delhi: Capital Publishing House, p.52

<sup>39</sup>Younghusband, Sir. Francis. 2008. *Kashmir*, reprinted, Srinagar: City Book Centre, p. 60

<sup>40</sup>Ibid. p.61.

<sup>41</sup>Ibid.p.61.; Mattan during the Dogra period was also considered a quiet green place, highly recommended by British Sahibs as a camp site. See Brigid Keenan, *Travels in Kashmir- A popular history of its people, places and crafts*, Delhi: Permanent Black, p.23.

<sup>42</sup>Monastery and site of Escorial Madrid – Built at the end 16<sup>th</sup> century on a plan in the form of a grill, the instrument of martyrdom of st Lawrence, the Escorial Monastery stands in an exceptionally beautiful site in castile. Its austere architecture, a break with previous styles had a considerable influence on Spanish architecture for more than half a century. It was the retreat of a mystic king and became, in the last years of Phillip II's reign, the centre of the greatest political power of the time. (See Kaul, Gwasha Lal (A Historical Survey- Kashmir Through the Ages 5000 to 1960), Gulshan Books, p.196.

great distance and the Spanish Sierra<sup>43</sup> cannot for a moment be placed in competition with the verdant magnificence of the mountain scenery of Kashmir.<sup>44</sup>

Every old building of whose origin the poorer classes of Kashmir don't have general information. They certainly believe them to be to have been the works of the Pandus.<sup>45</sup> There are three halls in the building, called *Ardhamandap*, *Anturla*, and *GarbhaGriha*.<sup>46</sup> On each face is a central cell, larger and higher than colonnade in which it is placed. The temple is enclosed by a colonnade or peristyle, which is 60 feet long and 38 feet wide. Its internal dimensions are 220' by 142'.<sup>47</sup> Ferguson further mentions the total number of pillars was 84 which was a sacred number to the Hindus, according to one explanation, the product of the number of days in the week and the number of signs in the zodiac. It has Grecian impact which is interesting.<sup>48</sup> Lawrence writes that its roof was of pyramidal form, and that the entrance chamber and wings were similarly that over the inner chamber must have been the loftiest the height of its pinnacle above the ground being about 75 feet.<sup>49</sup> B. Hugel doubts that Martand ever had a roof, but as the walls of the temples are still standing the numerous heaps of large stones that are scattered about all sides could be have belonged to the roof.<sup>50</sup> But Ferguson thinks that the roof and gateway were probably pyramidal in shape, but both have disappeared, perhaps because they were made of wood.<sup>51</sup> Mirza Hyder, describes it in his history "In the temple building there are chiseled stones up and down with no material for joints. The stones were laid one upon another without lime and *Surkhi*. Even the opening between the stones cannot hold a sheet of paper, and every stones measures 3-8 yards in length and one yard in thickness and width from one to five yards. The human mind is surprised to see as to how these big stones were carried and lifted during construction of temple".<sup>52</sup>

The vandalism of Martand sun temple started during the rule of Sultan Sikander of Kashmir is also confirmed by various historians/chroniclers including Jonaraja, Ferishta, author of *Baharistan-e-Shahi*, Mohibul Hasan etc. Ferguson says that the temple is said to have been despoiled by Sikander *But-Shikan* at

<sup>43</sup>The Sierra Nevada (meaning Snowy Range in Spain) is a mountain range in the region of Andalucía Province of Granada and Almeria in Spain.

<sup>44</sup>Vinge, G.T. *Travels In Kashmir, Ladak, Iskardo*, pp.360-361.

<sup>45</sup>The monarch of the Lunar race of ancient Hindu kings, who was driven from India, in the course of their wanderings, they visited Kashmir, and erected numerous temples, notably the temple of Martand. This kind of legend, however applies to every old building in the East of whose origin there exists no reliable information, all being considered by the Hindus the work of these princes or their immediate descendants. (See Kenan. B. 1975. *History of Kashmir and the Kashmiris: The Happy Valley*, Delhi: Seema publications, pp.254-255)

<sup>46</sup>Collet, J.A *guide for visitors*, p.92.

<sup>47</sup>Ferguson, *Kashmir- A Historical Introduction*, p.113.

<sup>48</sup>Collet, j.A *guide for visitors*, p.125.

<sup>49</sup>Lawrence, *The Valley of Kashmir*, p.172.

<sup>50</sup>*Ibid.* p.172.

<sup>51</sup>Ferguson, *Kashmir- A Historical Introduction*, p.114.

<sup>52</sup>Khuihami, H.S. *Tarikh Hassan*, vol-I, p.266.

the end of the fourteenth century.<sup>53</sup> In A.D. 1558-90, Abul Fazal mentions that some of the idolatrous temples were in perfect preservation; and Farishta himself describes many of these edifices as being existence in his own time, or about 1600 A.D.<sup>54</sup> Hassan adds "it took one year for Sulltan Sikander to dismantle it and was tired to demolish the original temple".<sup>55</sup> At least the interior of the temple was set on fire and its pictures were in a pell-mell condition. The author of the book visited this wonderful temple. On some pillars the gold paintings still exist as written by the author.<sup>56</sup>

Visitors who want to see this grand heritage can also travel to Achabal across the plateau lies over an easy level road. And the direction is extremely striking and pretty. The road after a mile or so makes a sudden descent to the valley of the river *Ārpath* which is crossed over a bridge. The adjoining land is cultivated for rice and has been planted with orchards. The road from Martand to Kuthar is a pleasing to walk. The people from different places used to celebrate *Eid* festival at this grand heritage site, thus presents a beautiful display all around the Ranbirpora. The people of Whole district have vogue and affection towards this site.

### III. CHATBAL- A SCENIC SITE

The scenic land of Chatbal is located on the remote corner of the east of the Pargana Kuthar. We can take the Achabal-Chittergul road to reach the destination. The duration of the journey is 80 minutes approximately from Achabal Mughal Garden. Chatbal is an offbeat holiday destination. It is a place where travellers tired of the hustle bustle of life can enjoy candle light dinners, snuggling up under cozy blanket and staying away from the routine hustle and bustle. A peaceful holiday destination, Chatbal doesn't offer a range of exciting tourist attractions yet. What it offers in abundance is peace, serenity and unspoilt natural beauty. About two years back in 2013, the government had approved a project and announced allocation of funds to develop Chatbal into a tourist spot.<sup>57</sup>

On a crispy day when the weather is pleasant, taking a trek on the mountains surrounding the Chatbal is a rewarding experience. Trekking through paths lined with apple and walnut trees on both sides, trekkers will feel close to nature and fall in love with the surroundings.<sup>58</sup>

The Department of Tourism should take into notice the need of separate Tourism Authority for the development of Chatbal as natural health resort on the analogy of Pahalgam. The Government should try to assess the developmental structure of Chatbal as an emerging tourist spot in Kuthar valley. Adequate

<sup>53</sup>*Ibid.*, p.114.

<sup>54</sup>Lawrence, *The Valley of Kashmir*, pp.166-167.

<sup>55</sup>Khuihami, H.S. *Tarikh Hassan*, vol-I, p.267.

<sup>56</sup>*Ibid.*, p.267.

<sup>57</sup> Sandeep Chatan reveals his overwhelming experience of Chatbal tour. 09 June 2014

<sup>58</sup> Sandeep Chetan's Travel blog, Travel photos and stories of his offbeat journey around India and the world.

facilities and suitable infrastructure like accommodation, roads, local transport, communication links and other essential amenities should be facilitated in order to ensure the visits of the tourists both from within and outside the state.

Through the proper development of Chatbal as a nascent tourism spot, can bring prosperity to the upper belt of the study area. Particularly the area above Shangus is considered as *kendi* (Barren). Thus rural tourism as supplemental income can contribute to the increase of wellbeing of this *kendi* area. The development of Chatbal will emerge as an important instrument for sustainable development including poverty alleviation, employment generation, and development of remote areas. The school children are interested for excursion and sporting activities. So the constructions of amusement parks need to be

taken up in order to capture the attention of the school children who often come to Chatbal for picnic. Despite that still children can be spotted racing down from the mountains and shepherds can be seen walking with flocks of sheep across the slopes of hills. The separate Tourism Development Authority for Chatbal and Achabal can gain prosperity to the area. KDA and Tourism Department together have taken the initiative for the construction of some huts at Chatbal. Over and above the spot should be included on the tourist map of the state that really can turn the fortunes of the people living in upper belt of the study area. They are living in stark and ridden poverty. Development of Chatbal around the concept of rural tourism will be an alternative package.



#### IV. POTENTIALITIES

The study area is also special because of the presence of grand heritage site of Martand. It is situated towards the north-west side of Kuthar. The State should develop adequate infrastructure at Martand and other sites of the Study area. The facilities which needed for tourists at Martand and other sites

include availability of hotels and restaurants, cafeteria, parking and small emporium of handicrafts or site museums besides guide books and other relevant literature about the site. Though it a protected monument under ASI, but pain sticking efforts should be taken for the development of this site as a full-fledged tourist site of the area. The roads should be facilitated in such a way so that the heritage tour towards Martand and other sites of Kuthar can provide easy and comfortable access. Keeping in view the

religious and cultural importance of this site, it can surely enjoy a wide scope and rich prospect to attract the tourists all around the globe. It is attracting the tourists every year but doesn't ensure a large scale tourist activity in the area. So the development of basic infrastructure for tourists and other accommodation units can create jobs for thousands of workers both skilled and unskilled of the area.

The Department of Tourism should introduce brochure shells- a folder with some photos or artwork. These brochures need to be displayed at the world fairs and send to the capital cities for global publicity. The government is unable to frame any such policy where these cultural and heritage sites are exploited to boost up the tourist industry of the land as it has been observed that cultural beauties are more attractive for tourists.

Martand site can serve as a catalyst of change in the study area, not only this it can also serve a major contributor towards state income. The problem of unemployment can be cured through the utilization of this site for heritage tourism. It can employ large number of people and can provide a wide range jobs which can extend from skilled to the highly specialized. A study made in India (on the basis of 1977 census) estimated that 681,102 persons were employed in all types of hotel and restaurant establishments and 1015,594 persons in the transport sector alone.<sup>59</sup> Thus the concerned agencies should also come forward and to preserve the glory of Mattan and Kuthar valley.

Department of tourism can develop *trout hatcheries* in the study areas like it did in Pahalgam, Kokernag and Achabal. Different springs and rivers of Kuthar can be perfect spots for angling and fishing activities. These water bodies can be excellent choice for beats of Brown trout and *Mahaseer*. As we already know trout fishing in Pahalgam and other areas of the valley are even popular outside the country, tourists from far and wide flock to these places. So same can be cultivated for the study area as well. It has become a major attraction for tourists in the Kashmir valley. Fishing tour to Kuthar and Mattan can be adventure sport that has a universal appeal. Trout fish farms and other sports can be attractive to visit and stay in the study area.

So developing rural areas of Kashmir can benefit the rural people and can encourage the development of rural tourism in the Valley. In the hilly areas of the valley, the production of land is very low because of climatic constraints and practice of single crop cultivation. For example, the villages lying on the banks of river *Arpat* in Kuthar area grow only a single crop of rice throughout the year because of climatic compulsions. The people of these villages mostly depend on the agriculture. Due to less production, they face poverty. To solve the problem of poverty, there is a need to avail of the allied sources of income generating options for these people. They have land but with least production, that needs to be utilized for farm tourism. The area also holds archaeological sites, monuments, shrines or we can say, cultural and heritage sites and nature based attraction known for its picturesque sight. Such units can be established and developed in such a way so that they cannot become the sites of attraction only but also tourism products for tourists. In addition, these units can be made as spots of recreation for the local

people.<sup>60</sup> These types of innovations in terms of rural tourism can become the instruments of the rural economy. So the land and heritage already available can be utilized for the upliftment of the area.

In a region like Kuthar, blessed with historic and natural sites and locations, there is much scope for accelerating the process of tourism and percolate its benefits to every segment of society. New areas need to be identified and developed in order to attract more tourists. Rural tourism can be a good option for developing the rural economy of the region. Rural tourism would showcase the diversity and uniqueness of rural life, rural art and craft works, agriculture, thereby increasing the visibility and the appeal of locally grown products. The government can promote rural tourism to ensure sustainable rural development.

The findings reveal the places of attraction are located in pocket routes. Pargana is very well connected to the district Anantnag in south Kashmir. Shangus Chittergul road connects the study area from south side and from north it can be reached through Mattan Chittergul road, which in turn connects with Phalgam route if the sites of Pargana Kuthar can be properly managed and advertised and if somehow catches the attention of Amarnath yatra then area can witness a good number of visitors that would generate the economy of the area.

Mattan Kharewa and Rural Kuthar have much to offer beyond agriculture. It has a great potentiality for different growing segments of tourism like Cultural tourism, agro-tourism, religious tourism etc. rich in cultural heritage and natural resources. There is a scope of rural tourism in the study area. This area has the resources, and man power.

Majority of the respondents during interviews do not agree that enough has been done to promote rural heritage tourism in the Pargana Kuthar and Mattan Pargana. Therefore, the assertion that the State Tourism Authority and KDA are not doing sufficient to promote cultural heritage tourism was supported by the respondents as correct.

Various expectations were indicated by the community and such responses were showing willingness to engage in rural heritage tourism development for the sake of their economic upliftment. The people have shown a positive attitude and do believe that rural tourism resources in their local areas can bring change in their living conditions. The finding clearly established the fact that no development has occurred for the promotion of heritage attractions. It had been so, all due to the negligence of the authorities.

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<sup>59</sup>Raina, A.K. Tourism industry in Kashmir, p.59.

<sup>60</sup> Lavksh, Misra. 1999. *Cultural Tourism in India*, New Delhi: Mohit Publications. p.267.



# Evaluation of Immobilized *Brachystegia Eurycoma* Seeds For the removal of $Fe^{3+}$ , $Pb^{2+}$ , $Cr^{2+}$ , $Cd^{2+}$ , $Cu^{2+}$ and $Mn^{2+}$ in Aqueous Solution

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**Abstract-** This research studied the sorption capacity of *Brachystegia eurycoma* seeds (BES) for the removal of heavy metal ions from waste water. The plant seeds was immobilized by entrapping or caging the bio-sorbent within a polymeric matrix of calcium-alginate to produce immobilized *Brachystegia eurycoma* seeds (IBES). The sorption efficiencies of heavy metals ( $Fe^{2+}$ ,  $Pb^{2+}$ ,  $Cr^{2+}$ ,  $Cd^{2+}$ ,  $Cu^{2+}$  and  $Mn^{2+}$ ) were investigated in aqueous solution using the IBES and the residual metal ions in solution was determined using atomic absorption spectrophotometer (AAS). The effect of various parameters such as contact time, pH, ionic strength, initial metal ion concentration and temperature variation on the sorption of the above metal ions were investigated using batch experiments. The result obtained showed that the sorption efficiencies of  $Pb^{2+}$ ,  $Cr^{3+}$ ,  $Cu^{2+}$ ,  $Cd^{2+}$ ,  $Fe^{2+}$  and  $Mn^{2+}$  by IBES were 97.50%, 67.44%, 81.48%, 98.09%, 79.50% and 94.00% respectively. Result also shows that metal ion sorption increases with increase in contact time; initial metal ion concentration and increase in pH, and decreases with increase in ionic strength. In view of the above result, the abundant but presently wasted *Brachystegia eurycoma* seeds can be used as a low-cost sorbent for the removal of heavy metal ions in waste water.

**Index Terms-** Immobilization, *Brachystegia eurycoma*, Seeds, Metal ions, Sorption capacity, Aqueous solution

## I. INTRODUCTION

Water is our lifeline that bathes us and feeds us. In ancient cultures water represented the very essence of life. The Romans were the first to pipe water into their growing cities, especially with their aqueducts (Onwu and Ogah, 2014). Water provides the Earth with the capacity of supporting life. An organism doesn't have to be told how important water is to their existence. The only organism that doesn't understand the importance of water is humans, especially in industrialized countries (Onudi *et al* 2010). With two thirds of the earth's surface covered by water and the human body consisting of 75 percent of it, it is evidently clear that water is one of the prime elements responsible for life on earth. Water circulates through the land just as it does through the human body, transporting, dissolving and replenishing nutrients and organic matter, while carrying away waste material (Onwu and Ogah, 2014).

Nowadays water pollution by heavy metals is fast growing due to natural processes and increasing human activities which include mining, agriculture, and manufacturing industries. These heavy metal ions are non degradable and cannot be detoxified biologically (korrapati and Parca, 2009). Lead (Pb) is among those contaminants that must be removed from water, due to its high toxicity and tendency to accumulate in tissues of living organisms. Heavy metals are among the contaminants in the environment. Beside the natural activities, almost all these contaminants goes into the non contaminated areas as dust, leachates through the soil. These are few examples of events contributing towards contamination of the ecosystems (korrapati and Parca, 2009).

Several methods are already being used to clean up the environment from these kinds of contaminants, but most of them are costly and far away from their optimum performance. Increased knowledge about eco-toxicological effects of heavy metals as well as increased legal requirements for reduction in industrial emissions necessitates research and development in the area of wastewater treatment. Since heavy metals accumulate in the food chain and because of their persistent nature, it is necessary to remove them from waste water (Onwu and Ogah, 2014).

Recent concerns regarding the environmental contamination have initiated the development of appropriate technologies to assess the presence and mobility of metals in soil, air water, and wastewater (Sanchez *et al* 2008). *Brachystegia eurycoma* whose seeds are employed as biosorbent in this present study is a plant that grows mainly along the river banks or swamps in Western and Eastern Nigeria. It is a large tree with irregular and twisted spreading branches. The seed has a roundish flat shape with brown colour and hard hull. In Nigeria, the main culinary use of the gum from *Brachystegia eurycoma* seed is in the thickening soups. Thickeners are usually added as condiments in the preparation of most soups. They are known to cause increased viscosity in soups, giving it more palatability and good mouth feel ( Onwu and Ngele, 2015). This property of *Brachystegia Eurycoma* seeds present it as a potential biosorbent (Osemeahon *et al.*, 2007).

The objectives of this study is to evaluate the application of immobilized *Brachystegia eurycoma* seeds with sodium alginate as a biosorbent for the removal of Iron, Lead, Chromium, Cadmium, Copper and Manganese from wastewater and for possible industrial application.

## II. MATERIALS AND METHODS

### 2.1 Materials

The materials used were Sodium alginate, Sodium chloride, Sodium hydroxide, Calcium chloride, and Hydrochloric acid. The chemicals were obtained from British Drug House (BDH). *Brachystegia eurycoma* seeds were obtained at Afikpo North Eke Market, Ebonyi State, Nigeria. The materials were used as obtained.

### 2.2 Methods

#### 2.2.1 Sample Preparation

The *Brachystegia eurycoma* seeds were dried, roasted, soaked in warm water and the shells removed manually and further dried in an oven at 60°C for 48hrs (Igwenyi and Akubugwo, 2010). They were milled with blender into powdery form and sieved with 100µm mesh to obtain a fine powder and then stored in a clean polyethylene bag ready for immobilization process (Wuyep *et al.*, 2007).

#### 2.2.2 Dispersion of *Brachystegia eurycoma* seeds

4.00g *Brachystegia eurycoma* powder were weighed and dissolved in a 100cm<sup>3</sup> distilled water and the mixture was poured into a separating funnel and left to stand for 12 hours for separation into various fractions.

#### 2.2.3 Preparation of Sodium alginate and Calcium chloride solution

Sodium alginate was prepared by weighing 4.00 g and making it up to 100 cm<sup>3</sup> mark with distilled water in a volumetric flask and left over night for complete dissolution to give 4 % w/v solution. Calcium chloride (0.12 M) was prepared by weighing 26.28 g into 1 litre volumetric flask and making it up to the mark with distilled water (Wuyep *et al.*, 2007).

#### 2.2.4 Immobilization Procedure of *Brachystegia eurycoma*(BE) Solution.

50 cm<sup>3</sup> of viscous layer of dissolved IBE seed was thoroughly mixed with 50 cm<sup>3</sup> of 4% stock solution sodium alginate and stirred vigorously for even mixing in a 250 cm<sup>3</sup> beaker. The mixture was transferred into another beaker containing 60 cm<sup>3</sup> of 0.12 M calcium chloride solution and the reaction allowed standing for 2 hrs for complete precipitation. The solid form was allowed to dry at room temperature for 7 hrs. The dry solid was washed in distilled water and stored in a clean polyethylene bag for further usage (Wuyep *et al.*, 2007).

The above process was repeated at different ratios of sodium alginate and IBE (100:0, 90:10, 80:20, 70:30, 60:40 and 50:50). The precipitates so obtained were dried and kept separately for further use (Wuyep *et al.*, 2007).

#### 2.2.5 Preparation of Synthetic Wastewater (Metal Ion Stock Solution)

Pb<sup>2+</sup>, Fe<sup>3+</sup>, Cr<sup>+3</sup>, Cd<sup>2+</sup>, Cu<sup>2+</sup> and Mn<sup>2+</sup> were the heavy metal ions chosen for this study. These metal ion solutions were prepared from their salts by dissolving 1.60, 3.55, 3.04, 1.63, 2.68 and 2.29 g of Lead nitrate, Iron (III) chloride, Chromium (II) chloride, Cadmium(II)chloride, Copper(II) chloride, and Manganese(II) chloride respectively in distilled water and making it up to 1 liter of solution to obtain 1000 ppm of each metal ion, then from the solution and using serial dilution, 200 ppm of each metal ion solution were prepared with distilled water. The synthetic waste water was kept for further use (Ogali *et al.*, 2008).

#### 2.2.6 Sorption experiment using Immobilized *Brachystegia eurycoma* seed

Experiments were carried out in the batch mode for the measurement of sorption capacities. From 200 ppm of each metal ion solution, 50 ml was taken into a 250 ml conical flask and 0.2 g of the immobilized *Brachystegia eurycoma* seed was added, corked with a rubber bung and shaken with a flask shaker for 2 hours at room temperature (30°C) at 150 rpm. The separation of the sorbents and solutions was carried out by filtration with Whatman filter paper No 42 and the filtrates were stored in sample cans for use. The residual metal ion concentrations were determined using Atomic Absorption Spectrophotometer (AAS) Buck Scientific Model 210. (Air /Acetylene Flame, Integrated Model) Normal Parameters for Fe, Pb, Cd, Cr, Cu and Mn. The percentage sorption was calculated using the following equation

$$\% \text{ Adsorption} = \left[ \frac{C_x - C_e}{C_x} \right] \times 100/1$$

Where C<sub>x</sub> = Initial metal ion Concentration and C<sub>e</sub> = Equilibrium metal ion Concentration (mg/l) (Osemeahon *et al.*, 2015)

#### 2.2.7 Determination of the Effect of pH on Sorption Capacity.

At different pH values (i.e. 1.0 to 6.0), the sorption characteristics of the IBES were investigated at 30°C. The pH of the solutions was adjusted using 1.0 M hydrochloric acid and 1.0 M sodium hydroxide. Concentrations of residual metal ions were measured as earlier reported by Charamthy *et al.*, 2001.

#### 2.2.8 Determination of Effect of Ionic Strength on Sorption Capacity.

The stock solutions containing known quantity of NaCl, were prepared and diluted to various desired concentrations (0.2-1.0 % W/W). 0.2 g of the sample was added to 50 cm<sup>3</sup> of each of the solutions and the equilibrium concentration of the residual metal ions were determined as reported by Wuyep *et al.*, 2007.

#### 2.2.9 Determination of the Effect of Contact Time on Sorption Capacity.

To determine the kinetics of the sorption for the metal ions, different sets of samples consisting of 0.2 g of the dried sorbent (IBES) and 50 cm<sup>3</sup> of the metal ion solution for each of the ions were prepared. Then the samples were shaken using flask shaker. Each set, was removed at time intervals ranging from 30 minutes to 24 hours and thereafter, the solution was filtered and analyzed for residual metal ion. This was done for all the metal ions at 30°C as earlier reported by Wuyep *et al.*, (2007).

#### 2.2.10 Determination of the Effect of Initial Metal ion Concentration on Sorption Capacity.

The effect of initial metal ion concentration on the sorption capacity of different samples was carried out. 50 cm<sup>3</sup> (each) of different metal ion concentrations ranging from 5 ppm-100 ppm and 0.2 g of the dried IBES were mixed together and shaken until equilibrium has been obtained 2 hrs. The artificial wastewater was filtered and analyzed for metal ion concentration as reported by Osemeahon *et al.* (2015).

## III. RESULTS AND DISCUSSIONS

### 3.1 Immobilization of *Brachystegia Eurycoma* seeds

The immobilization of *Brachystegia Eurycoma* seeds (IBES) was achieved by entrapping or caging it within the polymeric matrix of calcium alginate. It has been established that

sodium alginate consists of L. guluronic acid (G) and D mannuronic acid (M) units. The contacting of  $\text{Ca}^{2+}$  ions with guluronic acid blocks forms an ionically cross-linked structure in aqueous environment. The cross-linking of the polymer is due to binding of divalent cations ( $\text{Ca}^{2+}$ ) to the  $-\text{COO}^-$  group of L – guluronic acid block (Mary *et al.*, 2009).

Divalent cations  $\text{Ca}^{2+}$  act as a cross-linker and cause an ionic binding between G – blocks in polymer chains and forms three dimensional network (Negin, 2011). This network mobilizes *Brachystegia Eurycoma seeds* to produce a biosorbent.

### 3.2 Sorption Capacity of IBES

Moisture diffusivity is an important transport property, necessary for the design and optimization of all the processes that

involve internal moisture movement, including drying (Simpson, 1993). This result could be explained by the fact that for optimum biosorption, extra sites must be available for biosorption reaction, also shows the difference in the metal ion affinity, sorption capacity and availability of binding sites on the biomass account for the differences in sorption capacity of different metal ion. The maximum sorption percentage reached was 99.92% for lead and least at 90.13% for manganese. From Fig 1; The sorption capacity was 99.92%, 99.22%, 98.43%, 96.21%, 95.51%, 93.67% and 90.13% for  $\text{Pb}^{2+}$ ,  $\text{Cr}^{3+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Fe}^{2+}$  and  $\text{Mn}^{2+}$  respectively. The rapid sorption of metal ions can be attributed to the highly porous structure of the biosorbent which provides a less and large surface area for sorption of the metal ions to the binding sites (Ogbonna *et al.*, 2014).

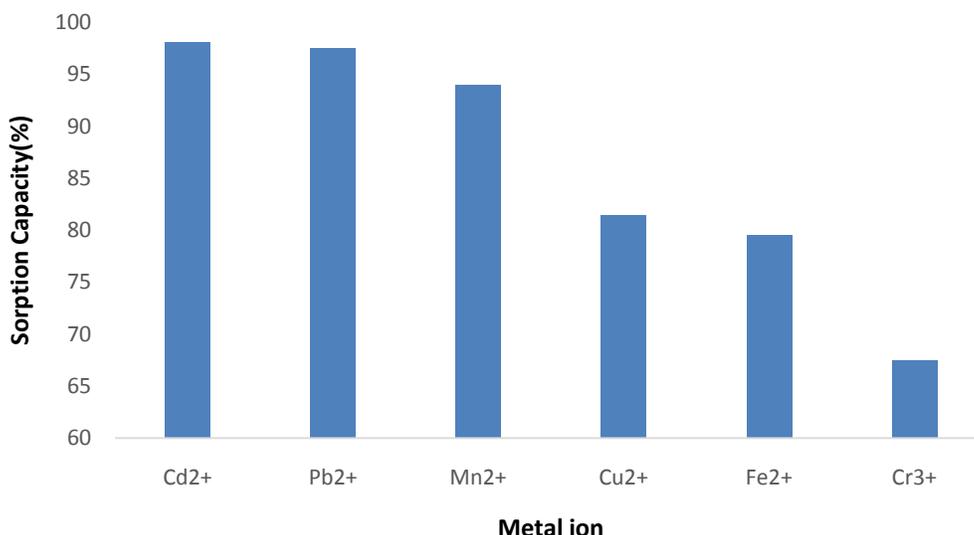


Fig 1; Sorption Capacity on metal ions of IBES

### 2.3 Effect of pH on Sorption of IBES

The amount of metal ions adsorbed onto the sorbent at the various pH values are shown in Figure 1. The sorption capacity of the biosorbent increased with increase in pH of the solution and maximum pH value for sorption of  $\text{Cd}^{2+}$  and  $\text{Mn}^{2+}$  by IBES was observed at pH 5 with sorption capacities of 98% for  $\text{Cd}^{2+}$  and 95% for  $\text{Mn}^{2+}$ . Generally the pH at which the metal ions recorded high sorption capacity are pH 4 for  $\text{Cr}^{3+}$  and  $\text{Cd}^{2+}$ , pH 5 for  $\text{Mn}^{2+}$  and pH 6 for  $\text{Pb}^{2+}$ ,  $\text{Fe}^{2+}$  and  $\text{Cu}^{2+}$  respectively. The difference in pH may have resulted from the protonation of the ligands at the surface of the IBES and precipitation due to formation of hydroxides. Also the generation of hydroxonium ions [ $\text{H}_3\text{O}^+$ ] in the bulk solution at different pH could result in competition between the hydroxonium ions and the metal ions for active sites and such a competition may have caused a difference in the amount of metal ions sorbed (Demirbas, 2008, Ogali *et al.*, 2008).

The interaction between the metal ions and the functional groups of the biomass depends on the nature of the biosorbent as well as the solution chemistry of the biosorbate, which in turn depends on the pH of the solution that considerably influences the metal speciation, sequestration, and/or mobility (Anayurt *et al.*, 2009).

The main factors influencing the pH on biosorption process were metal ions species and surface functional groups on the sorbents. It is generally known that at low pH values, concentration of  $\text{H}^+$  ions far exceeds that of the metal ions and hence  $\text{H}^+$  ions compete with metal ions for the surface of the sorbent which would hinder the metal ions from reaching the binding sites of the sorbent resulting in low sorption amount of metal. As the pH increases, there are fewer protons in the solution and consequently there is lesser competition with metal ions for binding sites. This results in an increase of the sorption amount of metal ions (Anayurt *et al.*, 2009).

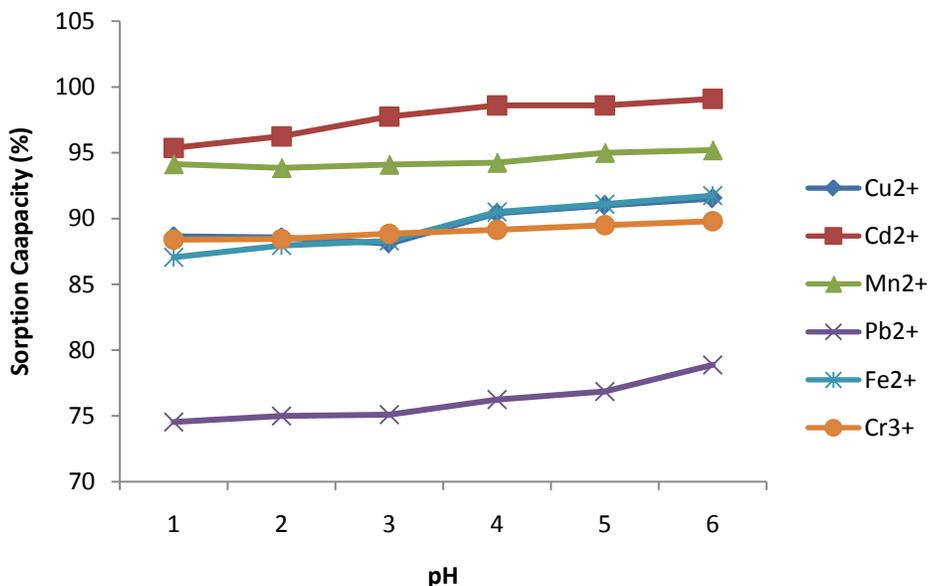


Fig 2; effect of pH on sorption capacity of IBES

### 3.4 Effect of Ionic Strength on Sorption of IBES

Another important parameter in biosorption is the ionic strength. The value of percentage sorption capacity decreased with increase in the ionic strength as shown in Fig 3; these may be as a result of less availability of active sites, surface area and capacity of biosorbent to concentrate on specific amount of metal ion sorbate in the aqueous solution (Adeyinka *et al.*, 2007). Also that high sodium concentrations lead to high ionic strength at which the amount of heavy metals bound is reduced (Greene *et al.*, 1987).

The difference in osmotic pressure between the sorbent and the external solution increases as the ionic strength of the external solution increases. Therefore, the sorption of metal ions decreases when the ionic strength of external solution increases as shown in Fig 3 (Adeyinka *et al.*, 2007; Reza and Amin, 2010), also active sites for sorption remain buried inside and do not take part in biosorption, resulting in poor biosorption capacity (Reza and Amin, 2010)

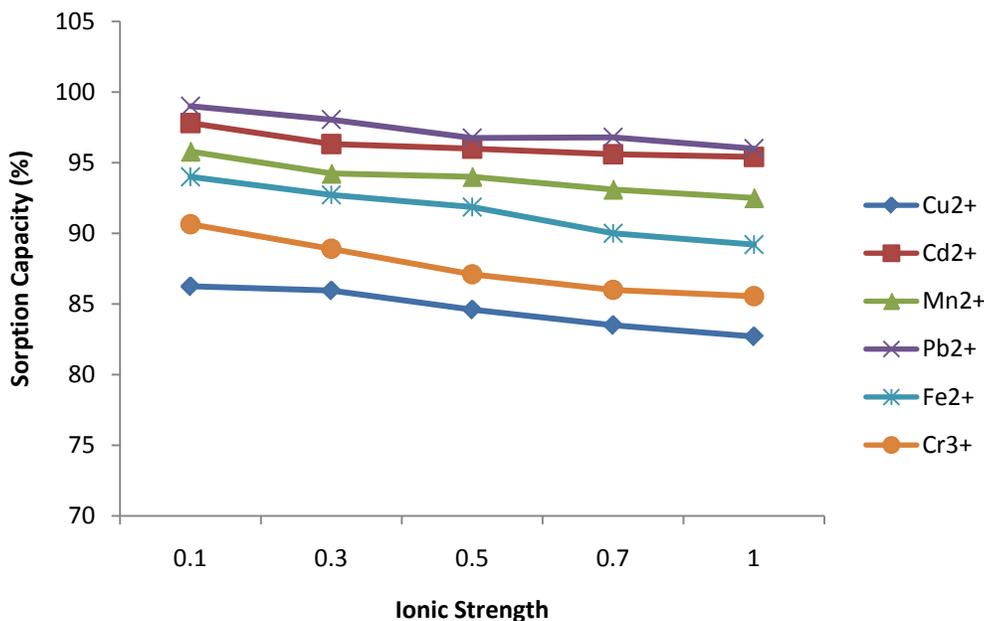


Fig 3; Effect of Ionic Strength on Sorption Capacity of IBES

### 3.5 Effect of Contact Time on Sorption Capacity of IBES

Fig 4; shows that the sorption capacity of IBES increased sharply with contact time in the first 30min and equilibrium sorption was established within 4 hours. The plot revealed that the rates of percent lead, iron and chromium sorbed are higher at the beginning. This was probably due to larger surface area of the plants being available at beginning for the sorption of  $Pb^{2+}$ ,  $Fe^{3+}$  and  $Cr^{3+}$  ions. As the surface sorption sites become exhausted, the sorption rate was controlled by the rate at which the sorbate is transported from the exterior to the interior sites of the sorbent particles. Most of the maximum percent lead, iron and chromium sorbed were attained after about 4 hours of time (Sham and Gad, 2010).

The rate of moisture diffusivity is an important transport property, necessary for the design and optimization of all the processes that involve internal moisture movement, including drying (Simpson, 1993). The reason for higher metal ions sorption rate at the beginning can be explained by the diffusion phenomenon. The rate of metal ions sorption depends on the difference between the saturation moisture content and the metal ions content at a given time, which is called the driving force. As hydration proceeds, the metal ions content increases, decreasing the driving force and consequently the sorption velocity decreases. The metal ions sorption process ceases when the sample attains the equilibrium in aqueous solution (Khazaei, 2008).

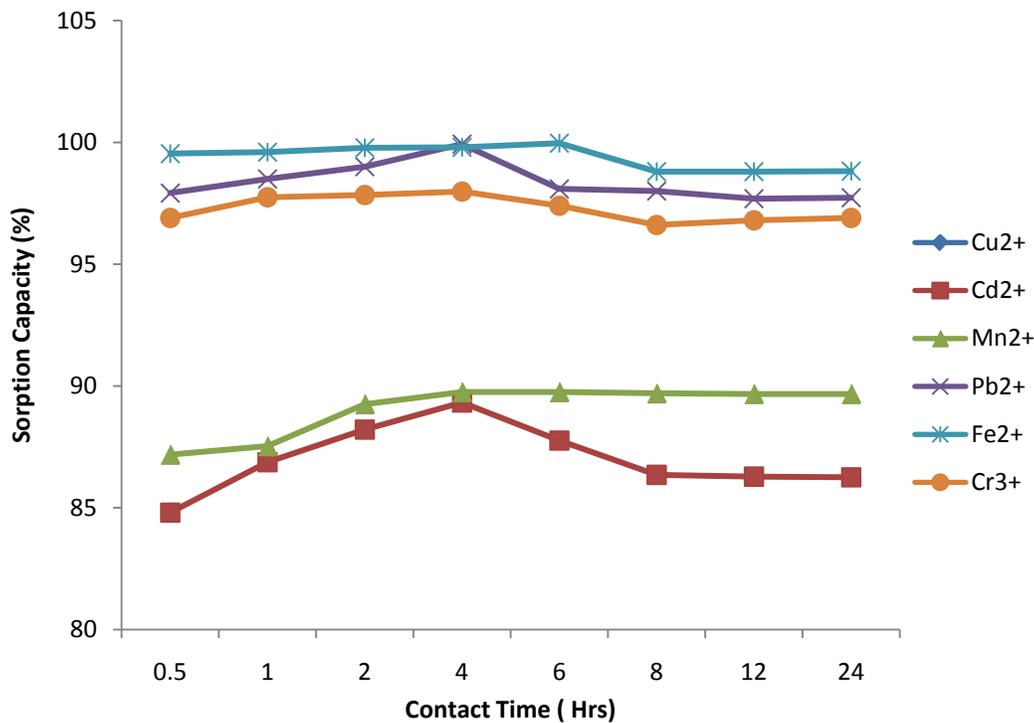


Fig 5; Effect of Contact Time on Sorption Capacity of IBES

### 3.6 Effect of Initial Concentration on Sorption Capacity of IBES

The result of metal ions sorption by IBES at different initial concentration is shown in Figure 6, indicating that the sorption capacity increases with an increase in the initial concentration of the metal ion. The phenomenon may be due to the feasibility and efficiency of a biosorption process not depending only on the properties of the biosorbent, but also on concentration of the metal ion. This behaviour can also be explained in terms of increase in flux of the metal ion. The flux of the metal ion varies directly with the metal ion concentration

and hence there should be an increase in flux with increase in initial concentration (Meunier *et al.*, 2004; El-Ashtoukhy *et al.*, 2008). The initial concentration provides an important driving force to overcome all mass transfer resistant of the metal ion between aqueous and solid phase (Addagalla *et al.*, 2009).

This result could also be explained by the fact that for optimum biosorption, extra sites must be available for biosorption reaction, whereas by increasing the metal ion concentration, a number of sites available for biosorption site has increased (Demirbas, 2008).

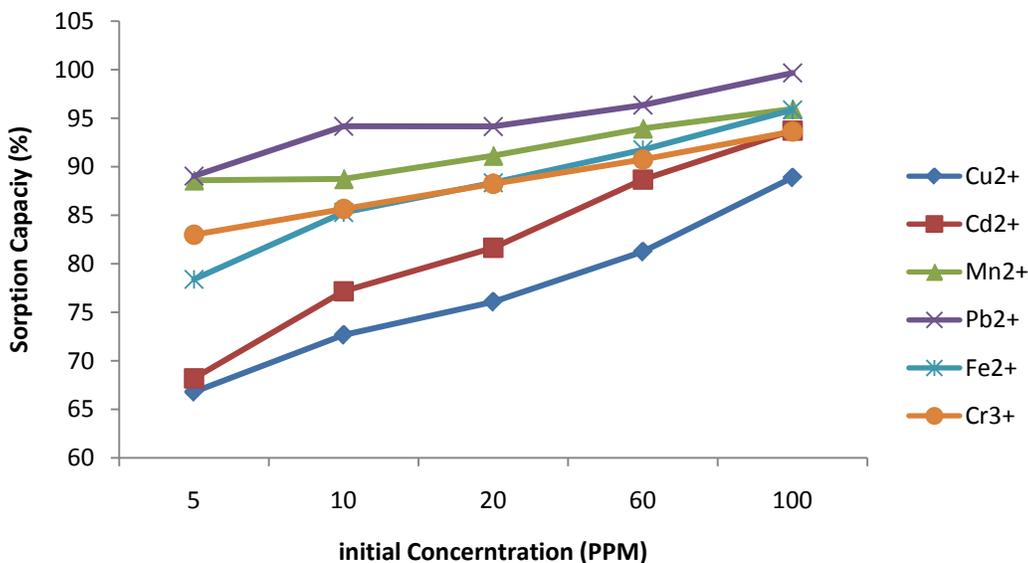


Fig 5; Effect of Initial Concentration on Sorption Capacity of IBES

#### IV. CONCLUSION

In this research work, the immobilization of *Brachystegia Eurycoma seeds (BES)* was achieved by caging it within a polymeric matrix with sodium alginate and calcium chloride. The result of sorption capacity recorded was satisfactory. The sorption capacity of IBES obtained for Pb<sup>2+</sup>, Cr<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Fe<sup>2+</sup> and Mn<sup>2+</sup> was found to be 97.50, 67.44, 81.48, 98.09, 79.50 and 94.00% respectively. In the same value, the sorption capacity decreases with an increasing ionic strength, but increases with increase in pH values, initial metal ion concentration and contact time. Based on the result obtained, it can be concluded that IBES can be evaluated as an alternative bio sorbent for removal of metal ions from waste water.

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# Biochemical Changes in Some Parameters of the Fish *Channapunctatus* on Exposure to Nickel

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**Abstract-** The discharge of xenobiotic substances like heavy metals into the aquatic systems has deleterious effect on the aquatic organisms including fishes. The present study was designed to see the subtoxic effect of nickel on the fish *Channapunctatus*. The protein, glucose and cholesterol content of tissues from liver, kidney, brain and ovary were analysed. The alternations in protein contents of all the tissues are significant in the level 0.001 in 40ppm nickel concentration. There was significant increase in glucose and cholesterol concentration of all the tissues in between the level 0.001 to 0.01 on exposure to in 40ppm nickel concentration in all the tissues. The lipid and protein content decreased in 40ppm in all the four tissues (0.001 to 0.05 level of significance). These significant alterations in the biochemical parameters of various tissues of *Channapunctatus* indicate deleterious effect of nickel exposure at subtoxic level also.

**Index Terms-** Xenobiotic substances, heavy metals, subtoxic effect

## I. INTRODUCTION

The direct or indirect discharge of pollutants into water bodies has resulted in water pollution which is a major global problem. Discharge of municipal sewage both domestic and industrial without any treatment which brings considerable changes in the river water quality has now become a threat to the ecosystem. Large scale, indiscriminate use of the pesticide, careless handling, accidental spillage or discharge of untreated effluents into natural water ways have harmful effects on the aquatic organisms including fishes and may contribute to long term effects in the environment.

Fishes play significant role in assessment of risk associated with water contamination as they are directly exposed to chemicals resulting from agricultural production via surface run-off or indirectly through food chain of ecosystem and thus can serve as bio- indicators. Pollution of aquatic ecosystem is recognized as a potential threat to aquatic organisms. And water resources are polluted due to discharge of effluents from various industries, agricultural run-off having insecticides, pesticides, heavy metals, fertilizers, chemicals, sewage and other domestic wastes. Heavy metals have been recognized as strong poisons and have a cumulative action among the various pollutants. Heavy metal contamination of water bodies has become a matter of great concern due to the damage caused to aquatic life especially fishes.

Once discharged into water bodies the heavy metals since they are non-biodegradable, get accumulated in the aquatic

organisms including fishes and cause detrimental effect on them. Health of aquatic ecosystems are being evaluated by using fishes as the physiological changes in the fishes can serve as biomarkers of environmental pollution.

European community has blacklisted nickel among the various heavy metals. This metal is released in the aquatic environment by industrial sources such as Ni-Cd batteries, plating processes, refining of ores, etc. Effluents from such industries are sources of Nickel in aquatic environment. Nickel does not breakdown in the environment and gets bio accumulated for many years after exposure to low levels of this metal. Nickel has been considered as an important xenobiotic, persistent and non-biodegradable chemical pollutant in the aquatic environment.

## II. MATERIALS AND METHODS

Several ecotoxicological characteristics of *C. punctatus* such as wide distribution in the freshwater environment, availability throughout the year, easy acclimatization to laboratory conditions and commercial importance make this species an excellent test species for toxicity and biochemical studies. The commonly available fresh water fish *Channapunctatus* is locally known as "Khabsi". It is also called spotted snake head due to presence a number of spots on its head. It is profusely available in Sambalpur area and is an air breathing fish. Due to this they can be easily kept in the laboratory for a long period of time and effects of Nickel can be studied in different tissues. Their weight varies from 30 to 35 gram and length about 10-15 cm.

Specimen were disinfected in 0.01%  $\text{KMnO}_4$  and acclimatized to laboratory conditions for 15 days in many large glass aquaria of 40 liters capacity. The water used in aquaria was chlorine free and changed every alternate day. They were fed daily with chopped earthworm but no food was given during experimental period to determine  $\text{LC}_{50}$  dose.

### Experimental set up

The experimental fishes *Channapunctatus* were divided into several batches of 10 each, irrespective of sex and a body weight of 30-35 grams. Various biochemical changes in the tissues in liver, kidney, brain and ovary were observed. Four groups of fishes were treated with 10, 20, 30 and 40 ppm Nickel for 30 days and a fifth group of fishes were kept as control. At a sub lethal dose of 10 ppm Nickel for 60 days and alternations in the blood parameters were analysed at 15, 30, 45 and 60 days of

exposure. The alternations were subjected to 't' test to ascertain, whether the changes were significant or not.

### Tissue Sampling

Tissues from above said organs was collected in liver, kidney, brain and ovary and were analysed for the glucose, cholesterol, protein and lipid contents after various days of exposure to nickel. Protein contents of the tissues were estimated by the method of Lowry et. al. (1957) using folins phenol reagent. Estimation of cholesterol, lipid were done by standard methods, Zlatkis et.al. (1953), Floch (1957), respectively. Yemm and Willis (1954) method was used to estimate glucose content.

### III. RESULT

The total protein contents in the tissues of liver decreased upto 31.46% (Fig.1) in 40ppm as compared to 0ppm on 30 days exposure to nickel. The total glucose and cholesterol contents increased significantly in all the tissues with the increased nickel concentration. Glucose contents increased upto 34.41 % (Fig.2) in 40ppm as compared to 0ppm on 30 days of exposure. At the same time with the increase in concentration of nickel upto 40 ppm the value of cholesterol increased steadily upto 36.85% (Fig.3). The lipid contents decreased significantly upto 38.11% (Fig.4) with an increase in the concentration upto 40ppm. On the exposure to nickel for 30 days the protein contents of kidney decreased upto 13.91% (Fig.16), glucose contents increased upto 31.05% (Fig.5), cholesterol contents increased upto 48.38% (Fig.6) and lipid contents decreased upto 23.23% (Fig.7) in 40 ppm as compared to 0ppm.

At the same time in the tissues of brain the protein contents decreased upto 24.93% (Fig.8), glucose contents increased upto 63.76% (Fig.9), cholesterol contents increased upto 24.57% (Fig.11) and lipid contents decreased upto 19.61% (Fig.10) in 40 ppm as compared to 0ppm on the exposure to nickel for 30 days. The protein contents of ovary decreased upto 12.78% (Fig.12) in 40 ppm as compared to 0 ppm on the exposure to nickel for 30 days. The glucose contents increased upto 38.33% (Fig.15) and cholesterol increased upto 71.88% (Fig.13) with the increased concentration of nickel upto 40 ppm for 30 days. The lipid contents of ovary decreased upto 23% (Fig.14) on 40ppm as compared to 0 ppm for 30 days.

### IV. DISCUSSION

The protein and lipid content of all the tissues decreased steadily in the test fishes when treated with acute and chronic sub-lethal concentration of Nickel. The decrease in the protein content may be due to malfunction of liver or due to reduced protein synthesis or protein breakdown. Ram and Satyanesan (1985) were of the opinion that the protein depletion, which occurs on exposure to various toxicants, may be due to rapid utilization of body protein or poor assimilation of dietary protein. Passow et.al (1961) have suggested that this protein depletion may be occurring due to blocking of protein synthesis and proteolysis on exposure to prolonged period of stress.

The glucose content of all the tissues showed a progressive and significant increase when the fishes were exposed to acute

and chronic sub-lethal doses. Sobha et.al (2007) also obtained similar increase in the glucose content in *Catlacatla* when exposed to cadmium. Shastry and Sunitha (1982) have reported alternations in the glucose levels in the tissues of *Channapunctatus* induced by cadmium, chromium and other heavy metals.

Similarly the cholesterol level in all the tissues also increased with the increased level of Nickel concentration. This increase in cholesterol may be due to decreased fatty acid oxidation in the tissues. Kumar et. al (2007) noted fluoride induced alterations in the cholesterol level of some tissues of *Clariasbatrachus*. Kumar and Pant (1981) have suggested that this decrease in cholesterol level of liver in fishes may be due to impaired cholesterol synthesis by the damaged liver cells. The decrease in lipid content may be due to inhibition of lipid synthesis or increased utilization of stored lipids as a source of energy to conduct normal metabolic functions according to Shashiet. al (1989) when exposed to the fluoride in rabbits.

### V. CONCLUSION

The toxic effects of heavy metals in fish have been demonstrated in the present study. It is found that metals induce a response in the fish as evidenced by alteration in the biochemical functional levels of different organs thereby increasing susceptibility to multiple types of disease. Since there is drastic changes in biochemical level in various organs of the fish in the present study it can be used as biomarkers for toxic effect of metal on fishes and can offer additional biologically and ecologically relevant information – a valuable tool for the establishment of guidelines for effective environmental management. Fish biomarkers are necessary for monitoring environmentally induced alterations to assess the impact of xenobiotic compounds (i.e. heavy metals) on fish. Also, it is suggested that all kinds of wastewaters, sewage and agricultural wastes must be treated before discharge into the aquatic systems and all articles of laws and legislations regarding the protection of aquatic environments must be taken into considerations and enforced.

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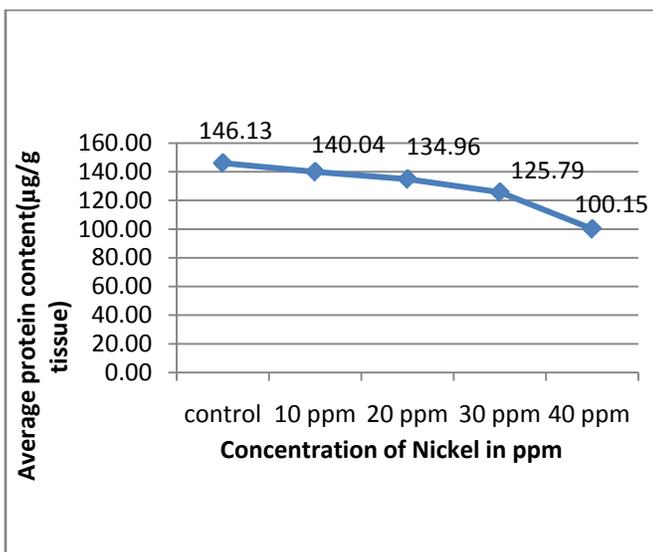
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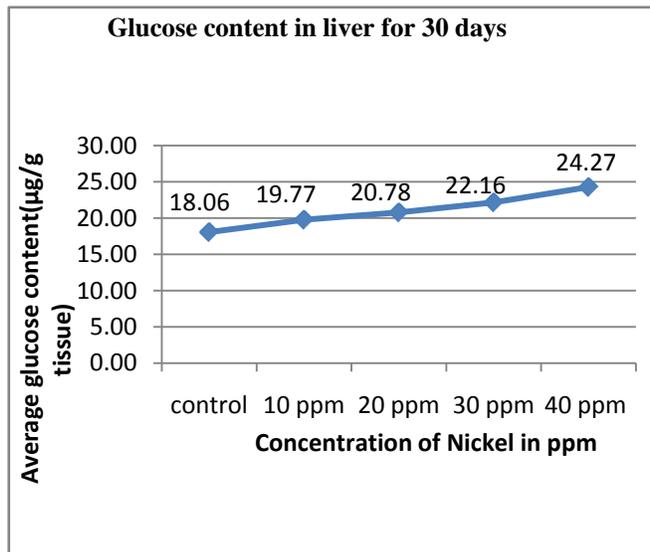
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**Fig 1. Protein content in liver for 30 days**



**Fig 2. Glucose content in liver for 30 days**

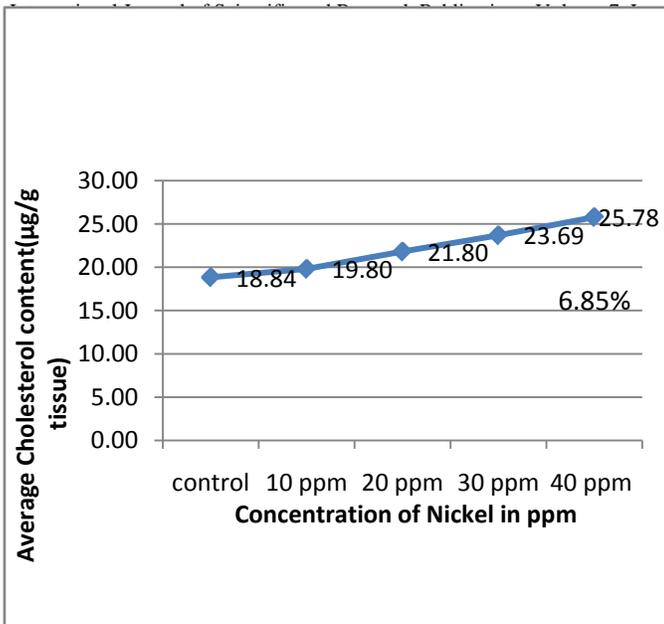


Fig 3. Cholesterol content in liver for 30 days

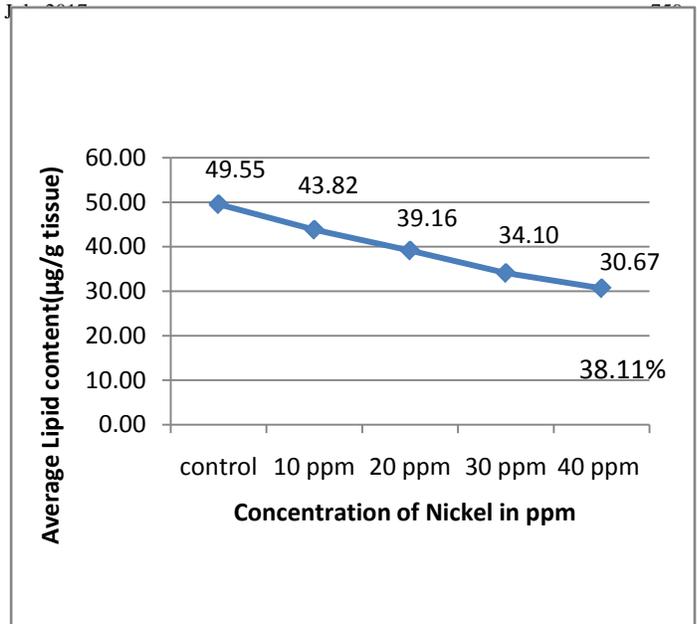


Fig 4. Lipid content in liver for 30 days

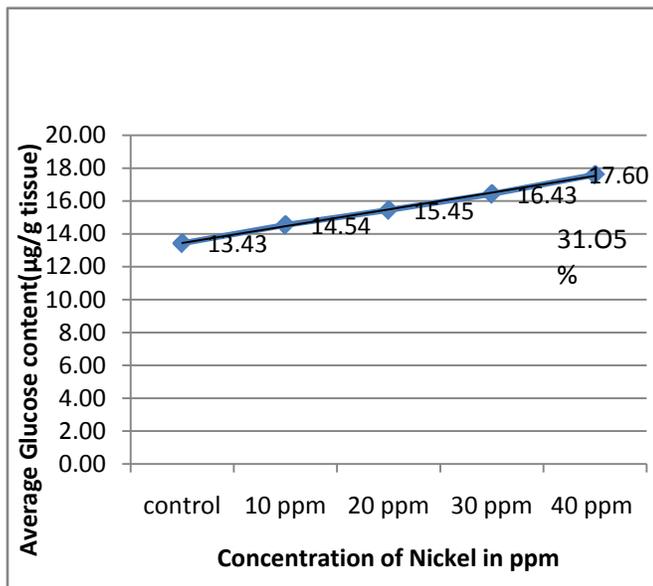


Fig 5. Glucose content in kidney for 30 days

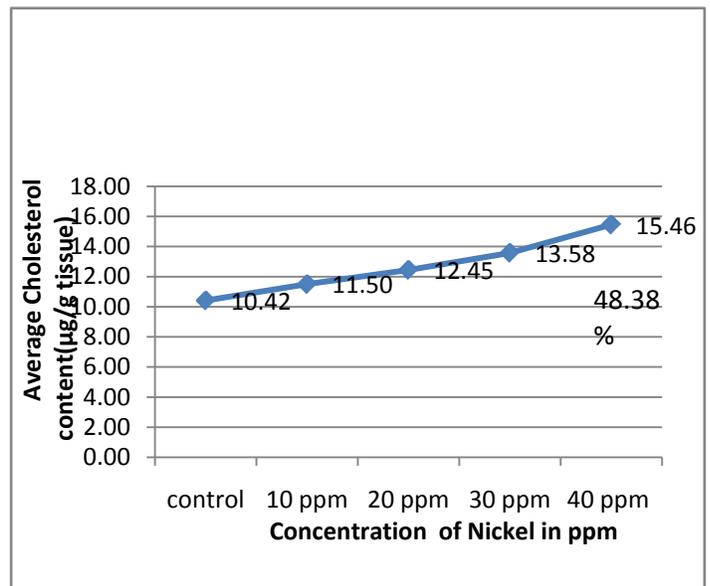
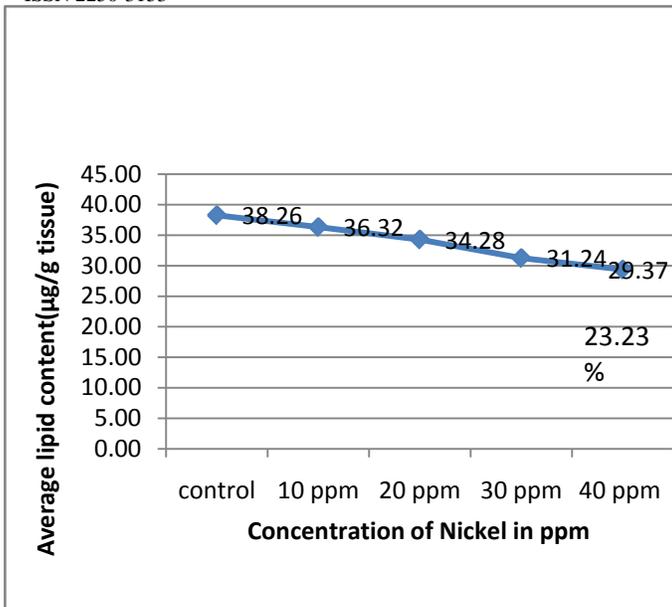
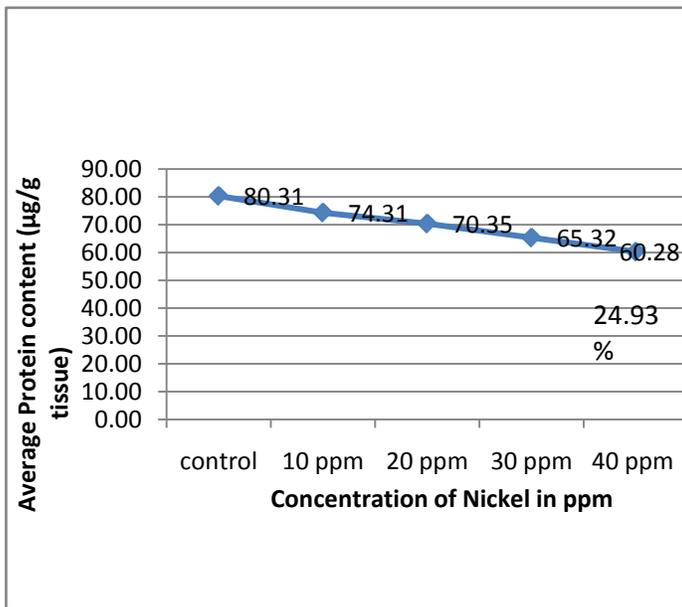


Fig 6. cholesterol content in kidney for 30 days



**Fig 7. Lipid content in kidney for 30 days**



**Fig 8. Protein content in brain for 30 days**

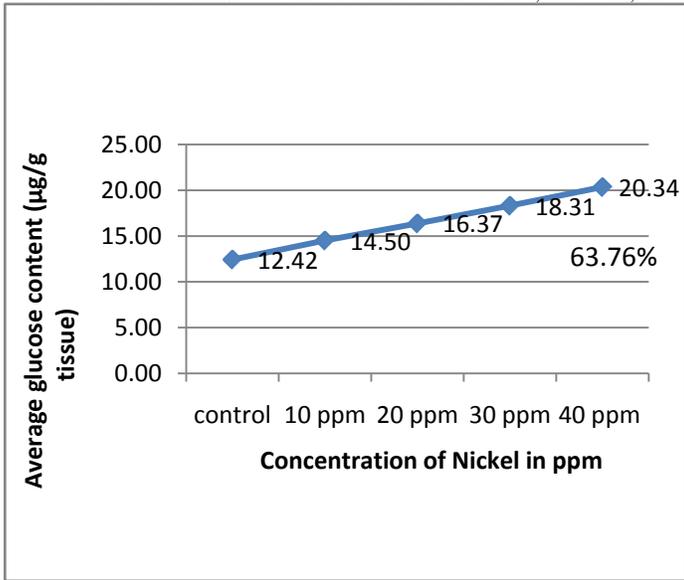


Fig 9. Glucose content in brain for 30 days

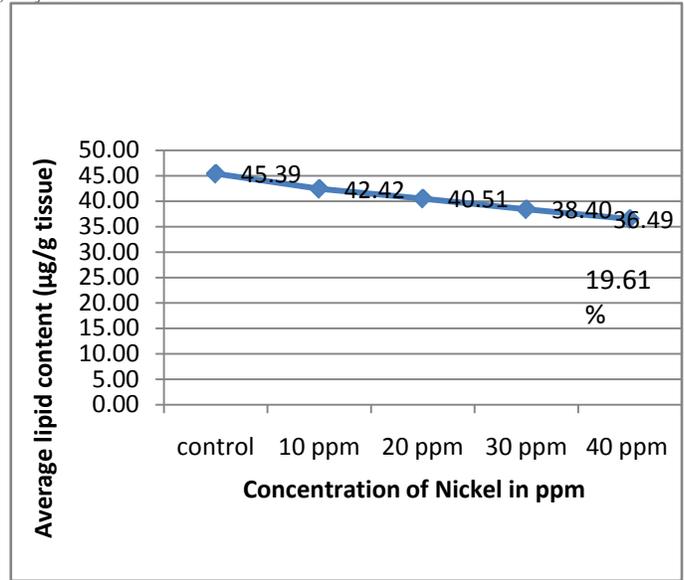


Fig 10. Lipid content in brain for 30 days

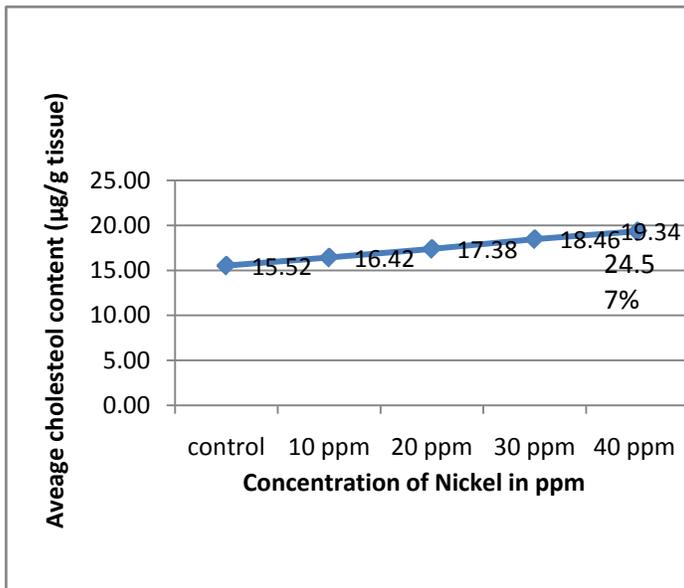


Fig 11. cholesterol content in brain for 30 days

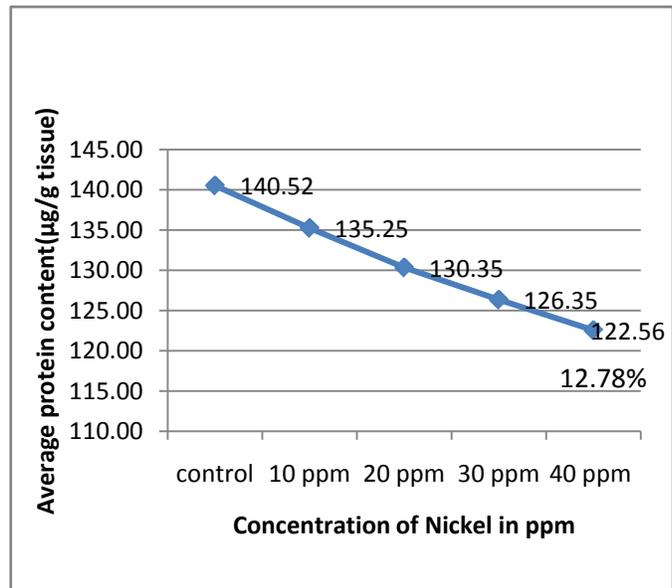


Fig 12. Protien content in ovary for 30 days

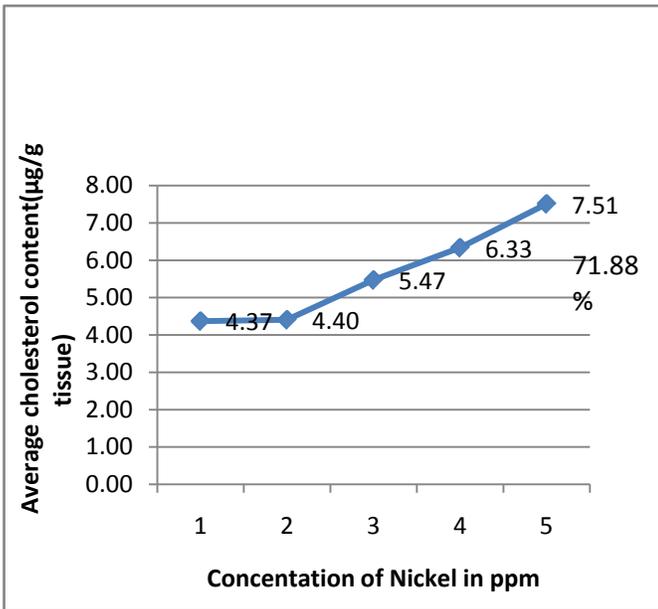


Fig 13. cholesterol content in ovary for 30 days

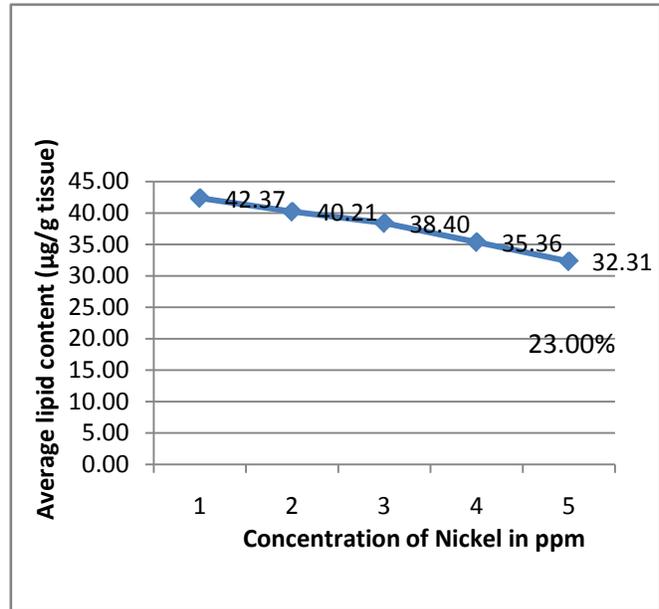


Fig 14. Lipid content in ovary for 30 days

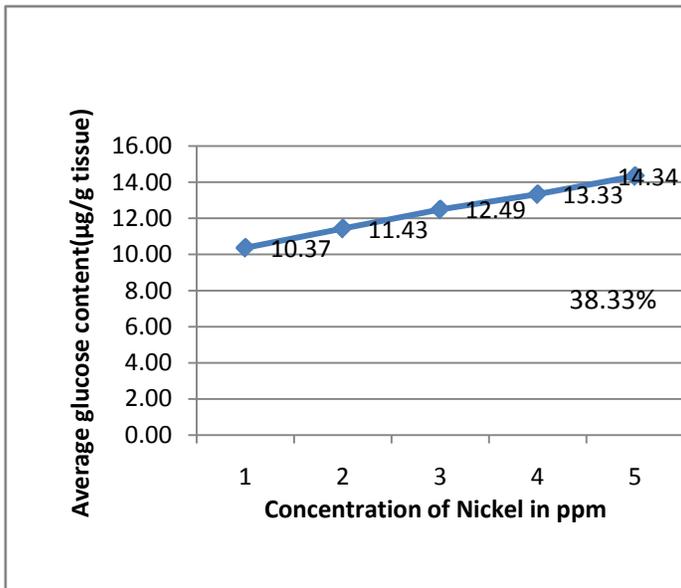


Fig 15. Glucose content in ovary for 30 days

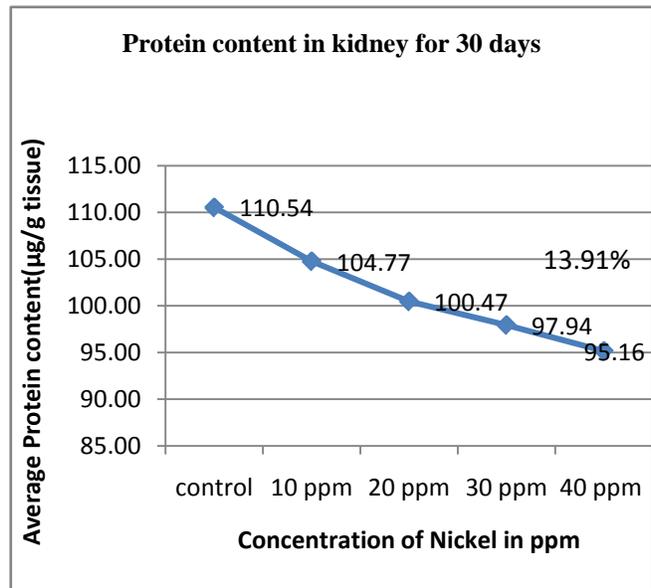


Fig 16. Protein content in kidney for 30 days

# Comparative Study of Fat (Total Cholesterol and Fatty acids) Profile in Farm cultivated and river water fishes communities of *Labeo rohita*

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**Abstract:** The present investigation deals with the study of, fat, cholesterol and major fatty acid content in river and farm cultivated *Labeo rohita* (Rohu). Triplicate samples of Rohu were obtained from the river flowing at Doiwala region of Dehradun (U.K) and from the cultivated farm. Fatty acids were determined by conventional biochemical methods, TLC and GC-MS. Fat content of farm cultivated Rohu ranged from 2.5-5 times that of river water samples. Monounsaturated fatty acids predominated in cultivated farm Rohu in comparison to Rohu in river water. Differences in fatty acid profile between river water and farm cultivated Rohu were greatest among polyunsaturated fatty acids; linoleic acid was substantially higher in all cultivated samples than in river water fish. Omega-3 fatty acid levels were also found to be highest in cultivated farm water fish in comparison to river water fish. The study thus indicates that, as per basis of nutritional screening in terms of omega-3 fatty acids, cultivated farm water Rohu are more appropriate for diet.

**Key words:** Omega fatty acids, nutritional requirements, farm cultivated, river water, Rohu.

## I. INTRODUCTION

Fish meat possesses high nutritional quality and is therefore a particularly recommended human dietary component. Information concerning the chemical and fatty acid composition of freshwater fishes is valuable to nutritionists who are interested in finding sources of low-fat, high protein foods, with desirable fatty acid compositions and acceptable amount of total cholesterol. Fish meat contains biologically active protein which is characterized by a very favourable composition of amino acids, a high omega-3 polyunsaturated fatty acid content such as eicosapentaenoic acid (20:5 n-3, EPA) and docosahexaenoic (22:6 n-3, DHA), and fat-soluble vitamins as well as it represents a good source of micro- and macro-elements. The shortage of  $\alpha$ -linolenic acid (18:3 n-3, ALA) is responsible for neurological disorders and poor growth [1]. DHA and EPA have been shown to have a positive effect in preventing hypertension and cardiovascular diseases [2]. Essential-polyunsaturated fatty acids such as ALA, EPA and DHA are not synthesized in the human body and effectively synthesized only by aquatic organisms; therefore, humans can receive these essential fatty acids by marine and freshwater fishes. The present study is in need to determine the important nutritional components present in fish, *Labeo rohita* (Rohu) as most of the population of India residing near the banks of the rivers and specific communities utilizes fish as their regular diet [3-6]. Recent studies were performed on *Labeo rohita* (Rohu) after exposure to phenolic compounds [7]. The study was performed to focus on the nutritional and pharmacological components of fish which makes the fish as an important nutritional and dietary supplement. The study was performed to describe the most important n-3 poly unsaturated fatty acids (PUFA) acids present in farm cultivated and river water *Labeo rohita* (Rohu) fishes communities.

## II. MATERIALS AND METHODS

### Collection of Samples

Sampling of farm cultivated and river water Rohu fish species was performed for the comparison of fatty acid composition from Doiwala region of Dehradun (U.K).

### Lipid extraction from meat

From fish muscle samples the total lipids were extracted [8]. Briefly mixture of chloroform - methanol solvent (2:1, v/v) was added to frozen samples in the ratio of 20:1 (v/w) of solvent – tissue. With solvent mixture the samples were homogenized three times for 10 minutes at 3000–4000 rpm. After each homogenization step samples were cooled at 4°C for 1 h. For 1 g of tissue 4 ml of 0.034 % of MgCl<sub>2</sub> was added. The extracts were incubated overnight at 4°C for complete partition of aqueous layer and organic (containing the extract of total lipids). The top aqueous layer was separated, and the bottom organic layer was dissolved with 2:1 (v/v) chloroform–methanol and placed into a glass tube. The total lipid fraction was obtained by evaporating the lower phase. The total lipids from the feed samples were extracted by soxhlet for 4 hours at condensation rate of 5-6 drops/ second, dry extract for 30 minutes at 100 °C cool. Total lipid contents were determined gravimetrically and stored at 4°C until analysis.

### Preparation of Fatty acid methyl esters and gas chromatography analysis

#### Preparation of Fatty acid methyl esters (FAME)

FAME was prepared by standard IUPAC method which involved the esterification of FA by methanol. Briefly, 100mg of fish lipid was taken in a 50mL round bottom flask; 20mL of chromatographic grade methanol was added followed by the addition of 0.5ml of 1N methanolic potassium hydroxide. The contents of the flask were refluxed for 30 minutes at 70 °C until the droplets of fats were disappeared. On cooling, the reaction mixture was gently transferred to a separating funnel; 10ml of n-hexane was added. Separating funnel was shaken gently. The upper hexane layer was recovered and mixed with distilled water. This hexane layer *will be* dried over anhydrous sodium sulfate and placed in sealed GC vials, kept at -20 °C until GC analysis.

#### Fatty Acid Analysis

The Fatty acid methyl esters (FAMES) were analyzed on a Perkin Elmer gas chromatograph model 8700 (Perkin-Elmer Ltd.) fitted with non bonded biscynopropyl siloxane stationary-phase, polar capillary column Rt-2560 (100 m x 0.25 mm) 0.2 µm film thickness (Supelco, Inc., Bellefonte, PA, USA) on FID. Oxygen-free nitrogen *will be* used as a carrier gas at a flow rate of 3.5 mL/min. Gas chromatographic conditions were as follows. The initial oven temperature was 150°C at rate of 4 min which was raised to 190 °C at a rate of 2°C/min and further to 220 °C held for 7 minutes. The injector and detector temperature were set at 260°C and 270°C respectively. A sample volume of 1.0 µL was injected. All of the quantification was done by a built-in data-handling program provided by the manufacturer of the gas chromatograph (PerkinElmer).

### III. RESULTS AND DISCUSSION

The total lipids, cholesterol content, fatty acids profiles include minor amounts of odd-number, branched-chain, and even-number fatty acids as well as saturated components, the mono unsaturated fatty acids (MUFA) and poly unsaturated fatty acids (PUFA) were determined in farm cultivated and river water fish's community of *Labeo rohita*. The major saturated fatty acids (SFA) were C14:0 and C16:0. The C18:1 was the prominent MUFA predominant in farm cultivated fishes. The dominant PUFA are of the omega-6 series and are found chiefly in C18:2 fatty acids in farm cultivated fishes. The essential fatty acids compositions showed prominence in C18:3n-3 and C18:2n-6 in farm cultivated fishes. The branched chain fatty acids identified C15:0, C16:0, C17:0, C18:2 and C20:0 in farm cultivated fishes. The results are shown in **Figures 1-3** and **Table 1**.

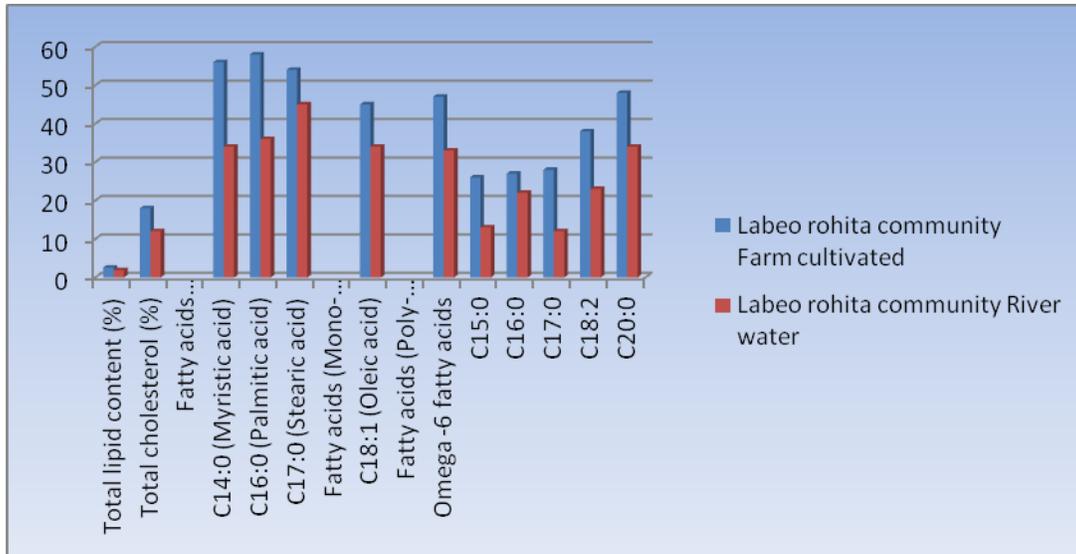


**Figure 1:** Preparation of fatty acid methyl esters (FAME) of (a) farm cultivated and (b) river water communities of *Labeo rohita*

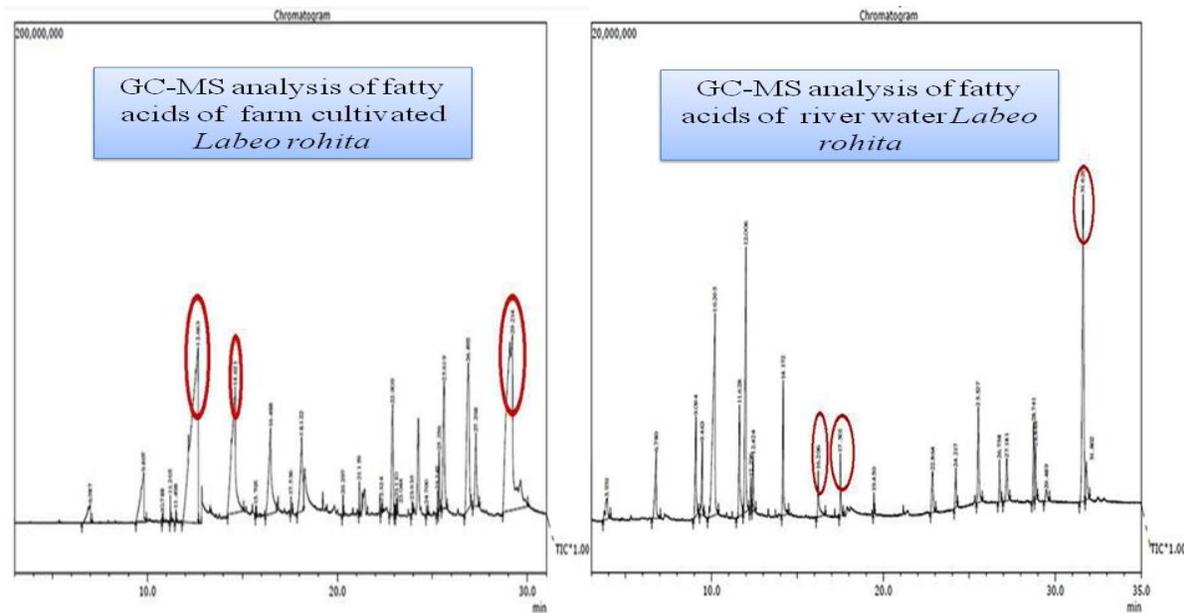
**Table 1:** Percent content of fat related parameters in farm cultivated and river water communities of *Labeo rohita*

S.No.	Fat content related parameters	Labeo rohita community	
		Farm cultivated	River water
1	Total lipid content (%)	2.56	1.89
2.	Total cholesterol (%)	18	12
3.	Fatty acids (saturated) (%)		
	C14:0 (Myristic acid)	56	34
	C16:0 (Palmitic acid)	58	36
	C17:0 (Stearic acid)	54	45
4.	Fatty acids (Mono-unsaturated) (%)		
	C18:1 (Oleic acid)	45	34
5.	Fatty acids (Poly-unsaturated) (%)		
	Omega -6 fatty acids	47	33
	C15:0	26	13
	C16:0	27	22
	C17:0	28	12

	C18:2	38	23
	C20:0	48	34



**Figure 2:** Percent content comparison of fat related parameters in farm cultivated and river water communities of *Labeo rohita*



**Figure 3:** Peaks (fatty acids) variation as determined via GC-MS chromatogram of fatty acids extracted from farm cultivated and river water communities of *Labeo rohita*

#### IV. CONCLUSION

Cultivated Rohu fish exceeded their wild counterparts in total fat, by as much as five times. Differences were found in total fat and most fatty acids between cultivated and river water fishes. Ratios of fatty acid classes in individual foods may not be an appropriate reflection of the nutritional contribution of various fatty acids. The present study thus suggest the importance of cultivation and rearing of edible fishes as is justified by the results. Proper feeding and nutrition enrichment leads to the good quality fishes which are safe as per nutrition point of view.

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# The Implementation of Kafalah in Islamic Banking and Finance Organizations in Malaysia

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**Abstract-**The concept of Islamic Banking and Economics is recognized essentially, it is now our responsibility to establish Kafalah as an individual concept. An attempt has been taken in this article to define Al-Kafalah, to recognize its superior structures and values, and to prove the clearness of its entity. However, the fact is traditional authors used to deny the contributions of Islam towards Islamic contract. But in Islam, the administrative applications were impending from the beginning of civilization the messengers of Allah (SWT) and it concluded in the last prophet Muhammad (SAW). Nowadays, the golden history of the Muslims is controlled day by day by secular and money-oriented managerial concepts due to lack of research and deviation from Islam. Unfortunately, many managerial concepts from conventional side persist inappropriate to the organizations of Muslim society. Accordingly, Islamic Organizations from family to the national level cannot appear dynamic role in appraisal to conventional groups. Thus, it is recommended in the present study to practice Kafalah based on Shariah principles and application of motivational practices according to Quran and Sunnah. Finally, the restraints and possible helpful measures of Kafalah have been pointed out.

**Index Terms-** Kafalah Implementation, Islamic Finance, Malaysia

## I. INTRODUCTION

The Shariah contract-based monitoring policy is anticipated to promote clearness and reliability of Shariah contract application. It enhances the certainty and strengthens Shariah compliance of the contract by IFIs. One of the Shariah contracts is Kafalah which is used by the IFIs. Kafalah denotes to a contract that creates a guaranteed party's indicated liability as a joint liability of the guaranteed party and the guarantor. Kafalah is used by the IFIs to offer guarantee services, such as a letter of credit and shipping guarantee, bank guarantee in the perspective of Islamic financial transactions. It is also used as one of the contracts to increase several primary Islamic financial products, mostly for risk-minimization purposes, such as Musharakah, Mudharabah, Murabahah, Ijarah, Salam, and Istisna and Tawarruq. The nature of Kafalah is to deliver guarantee on the fulfillment of the requirement of the guaranteed party's liability. Kafalah is obligatory on the guarantor. The mechanisms of a Kafalah involve to the contracting parties, namely the beneficiary (makful lahu), the guarantor (kafil), and the guaranteed party (makful 'anhu), which is an offer (ijab) and acceptance (Qabul) and Subject matter based on the evidence of Bank Negara Malaysia.

The management of the Kafalah is also focused on the study of Bank Negara Malaysia which is based on the rights and obligations. It actually depends on the guarantor may offer Kafalah without conditions (unrestricted Kafalah) or with conditions (restricted Kafalah), the guarantor under an unrestricted Kafalah will be liable in accordance with the terms and conditions of the original liability and also the guarantor may offer a restricted Kafalah whereby the terms and conditions of the guarantee are identified. The stated terms and conditions may comprise time, actual date, activate events, amount or any additional terms and conditions of the guarantee which are acceptable by Shariah, the beneficiary can claim his rights from the guaranteed party the full amount of the liability from either of them or a part of the liability from the guaranteed. If the guaranteed party is unable to settle his liability, it depends on the guarantor requires a condition that the beneficiary will first claim from the guaranteed party and will only claim from the guarantor. The Kafalah contract remains enforceable unless otherwise specified and if the beneficiary grants the guaranteed party an extension period to settle the liability, such extension shall also apply to the guarantor, if the guaranteed liability becomes claimable before its maturity due to the demise or dissolution of the guaranteed party or any agreed trigger events. However, if the extension period to resolve the liability which is still due is approved by the recipient to the guarantor instead of the guaranteed party, in which, an extension may not be

automatically applied to the guaranteed party. The IFI may develop a complete governance and oversight framework for the Kafalah so that, it is conducted based on good business practices and Shariah compliance. The Board of Directors of an IFI must guarantee the complete internal policies governing Kafalah transactions are accepted, recognized, and followed to at all time by the IFI. The application of Kafalah contract is in line with the IFI's business and risk management policies. Even they must control the internal policies are studied frequently in order to persist current, significant and suitable to confirm the operational conduct and risk profile of Kafalah transactions are achieved correctly. The Board must approve any material changes to the internal policies. There are lots of Shariah-related matters which are recognized by the Shariah Committee (SC). The Bank and internal policies established by the IFI conduct independent reviews regularly to assess compliance with the standards.

The IFI may include the terms and conditions which have Shariah requirements in the Kafalah contract. They cover the main terms including the roles and responsibilities of the contracting parties, tenure of guarantee, guaranteed amount, fees and charges, purpose of guarantee, expiry date and claim period, claims procedure, recourse and recovery terms with the recourse period, forms of notification and payment method, fee refund procedure, if applicable, in the event of early breach of the Kafalah contract; and collateral including the types of securities, tenure, and criteria to issue the collateral or security. There are also two more issues such as breach and accomplishment events of the Kafalah contract and requirements for all contracting parties to confirm constant compliance with Shariah.

## II. KAFALAH IS THE SERVICE BASED CONTRACT IN ISLAMIC FINANCE

### 2.1. Legality

Kafalah can be seen in the Sunnah of the Prophet Muhammad S.A.W., where Abu Qatadah asked the Prophet to pray for a man to whom he (Abu Qatadah) had been a guarantor for a debt (Al Bukhari, Al-Jami' Al Sahih,3/94).

In more recent times, AAOIFI Shariah Standard No.5 has stated that guarantees are allowed with regards to contracts of exchange and also contracts of property.

### 2.2. Condition

In Kafalah there are four basic rules and conditions the parties must adhere to (Al-Zuhayli, 2003; Badri & Bouheraoua, 2013; Dusuki, 2011).

- a. Guarantor who is of sound mind has legal capacity and willingly gives his consent and agreement to the contract.
- b. Debtor, he does not need to have legal capacity and can even be a minor, insane person or a bankrupt.
- c. Creditor who must be known to all parties.
- d. Guaranteed object or asset. This asset must be an actual asset that is possible to collect from the guarantor. It should be an asset that can be legally owned and sold should the debtor fail to fulfill his obligations.

### 2.3. Application of Service Based Contracts

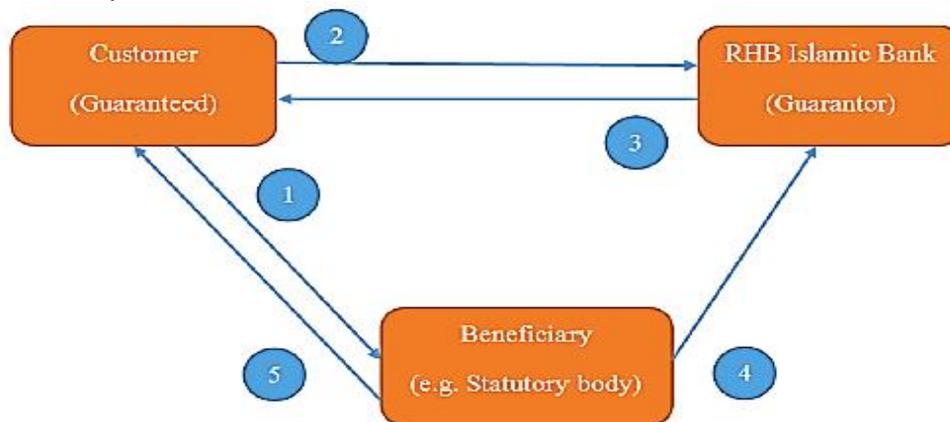
According to (Rifki Ismal, 2010), Kafalah is the guarantee for a loan and all loans must be repaid in due course according to Islamic law. The law allows the lenders to demand some sort of security for the loan in the cases where the borrower fail to repay the loan. As for the Shariah Advisory Council of Bank Negara Malaysia, kalafah is defined as a guaranteed contract on certain asset, usufruct and/or services provided by a guarantor to the parties involved. In international trade and finance, kafalah plays an important role in facilitating trade across border by which the bank is asked as a guarantor of payment in the international trade transaction. Islamic banks are able to offer bank guarantee, standby letter of credit and shipping guarantee using the concept of kafalah.

However, this study also focuses on all of the classical instruments; there are only some of them which are available and well developed in the Indonesian Islamic banking industry. In the forms of equity-based financing, there are Musharakah and Mudarabah contracts while in debt-based financing there are Murabahah, Salam, Istisna, Ijarah and Qardh. In service-based financing or simply named as the other types of financing, there are Wakalah, Kafalah, Sharf and Hiwalah Rifki Ismal also studies on this paper about particular data investigation on the share of financing instruments over total financings from December 2000 to September 2008 suggests that Murabahah, Salam and Istishna are the most utilized financing instruments dominating 59.5 percent of the total financings. Following those instruments are Musharakah and Mudarabah (equity-based financing instruments) with the share of 36.4 percent of the total financings. Finally, there are Ijarah, Kafalah, Wakalah, Hiwalah and Sharf (the other types of financing instruments) as the least usable financing instruments with the share of only 4 percent of the total financings.

Additionally, kafalah can be used to indemnify a third party from financial losses if one party fails to perform its part of the deal. Such application is used in the form of letters of guarantees (Kureshi and Hayat, 2014). In Malaysia, the guarantee facility is not only issued by Islamic banks but also by financial institutions such as Cagamas SRP Berhad and Credit Guarantee Corporation Berhad (Badri and Bouheraoua, 2013).

### 2.3.1. The use of Kafalah in RHB Islamic Bank

According to Maryam Sofia Mohd Suhaimi, Maryam Syamilah Md Fauzi et al in 2016, the practice in Malaysia had shown that Kafalah concept is usually practiced by Islamic Banks in trade financing sector in two products which are bank guarantee-i and shipping guarantee-i. For this segment, we will be focusing on the bank-guarantee-i product from RHB Islamic Bank (RHB Group, 2016). The diagram illustrates how Kafalah is undertaken in a letter of guarantee by RHB Islamic Bank.



### The Structure Flow of Islamic Bank Guarantee (IBG) from RHB Islamic Bank

Maryam Sofia Mohd Suhaimi, Maryam Syamilah Md Fauzi et al also say that customer enters into a contractual agreement with the beneficiary to fulfill an obligation and customer approaches RHB Islamic Bank to request the issuance of Islamic Bank Guarantee (IBG) facility as well. Moreover, RHB Islamic Bank issues IBG to the customer, as a surety to discharge the liability of beneficiary in case the customer defaults. In return, a sum amount of fee is charged to the customer. For instance, in the event of default by the customer, the beneficiary will claim from RHB Islamic Bank. RHB Islamic Bank makes immediate payment on first demand provided the claim meets all the conditions of the guarantee. In addition, if there is no default, the beneficiary will return the IBG to the customer followed by RHB Islamic Bank's cancellation upon maturity.

### 2.3.2. Shariah issues based on the above structure

In bank guarantee-i, the guarantor (RHB Islamic Bank) charges the customer a certain fee. However, this practice remains a matter of debate among Shariah scholars (Badri and Bouheraoua, 2013). This is because some scholars like Hanafi, Shafie, Maliki and Hambali schools did not permit charging fee for a guarantee due to the nature of the contract (benevolent contract) and in the condition the customer defaulted, the relationship between the guarantor and guaranteed party will change into debtor creditor, thus, charging a fee will lead to riba.

In contrast, some contemporary scholars like Shaykh Ahmad Ali Abdullah from the OIC International Islamic Fiqh Academy permits charging a fee provided that the guarantee is not in the form of a loan (Qard). Besides that, there is no issue on riba as the commitment provided from the guarantor is considered as counter value following the fiqh maxim - al kharaj bi daman (profit comes with liability). The Shariah Advisory Council of Bank Negara Malaysia has allowed charging fee on letter of guarantee based on this basis.

As a resolution, the stand of the Islamic Fiqh Academy of the Organization of Islamic Cooperation (IFA-OIC) and Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) is that charging a fee for guarantee is only allowed when it involves the actual cost such as legal fees, documentation, administrative costs and stamp duty.

A. *The method used by RHB Islamic Bank in determining the actual cost*

RHB Islamic Bank used one of the three methods in charging fees on bank guarantee-I which is by calculating the actual cost (Syed Alwi et al., 2014). Although this method is allowed by AAOIFI, one thing to ponder is how the bank calculates its actual cost. There are always risks that the bank imposed unnecessary fees to increase the profit margin.

B. *The guarantee that the customer will pay back to the bank*

RHB Islamic bank and some other banks accept collateral or pledge or cash deposits from the customer before agreeing to issue the letter of guarantee to secure the bank's risks. Islamic banks are not exposed to any cash outlays unless their customer defaults on the performance of a certain act (Kureshi and Hayat, 2014).

### III. THE APPLICATION OF AL-KAFALAH IN MALAYSIA

The establishment of BIMB in 1983 marked a milestone in the Malaysian banking system as it provided an alternative to the existing conventional system. Having operations based on Islamic principles which prohibit interest, it is able, therefore, to fulfill the needs of the Muslim population. At present, BIMB offers services which are similar to those services available at other conventional commercial banks. BIMB accepts savings and demand deposits under the principle of Wadiah. It also accepts time deposit which is known as "investment deposit" under the principle of Mudharabah. It grants credit facilities such as project financing under principles of Mudharabah and Musyarakah, lease financing under the principles of Al-Ijarah and Al-Takjiri, hire-purchase financing under the principles of Al-Bai Bithaman Ajil, trade financing under the principles of Mudharabah, Musyarakah, and Wakalah, and guarantee under the principles of Al-Kafalah according to Sudin Haron, Norafifah Ahmad and Sandra L. Planisek in 1994.

In 1998, Sudin Haron studies that although Pakistani banks and BIMB seem to have many Sharia principles for their fixed charges category, these principles can be grouped together within the principles of service charges. In Pakistan for example, development charges and service charges are terms used in imposing charges on customers. Similarly in Malaysia, the principles of al-wakalah, al-kafalah, al-hawalah, and al-ujr are terms used by BIMB to represent the nature of services rendered to customers and how charges will be imposed on customers for using these services. Iran also has an additional principle within this category called 'joalah'. This concept refers to the undertaking of one party ja'el or employer (either bank or customer) to pay a specified amount of money or wage to another party in return for rendering a specified service in accordance with the terms of the contract. This principle, therefore, is similar to the principles of commission and service charges of other countries.

Another study is conducted by Rosita Chong, Raihana Firdaus Seah Abdullah, Alex Anderson, and Hanudin Amin in 2009 that variable rate of financing (VRF) was first introduced in Malaysia in 2003 and has been widely applied to house, property, trade financing and other type of financing. The introduction of VRF by the Malaysian's Islamic Banking industry (Central Bank of Malaysia) is to ensure that the fund user enjoys a competitive rate of repayment in time of economic volatility, where the market interest rate (BLR) fluctuates.

In the other study, Bouaziz Cheikh says in 2013 that other early traditions practiced by Islamic and pre-Islamic Arab tribes also constitute the origins of Takaful; these include Diya, Kafalah, Aqd muwalat, Ju'hala, Daman Khatar Al-Tariq and Hilf. Diya is the indemnity paid as "blood-money" to the next of kin or the injured party of a murder victim; Kafalah is a surety-ship whereby a third party guarantees the performance of another party involved in a contract, it was used to assist victims of hazards on trade routes.

In addition, Zakaria bin Bahari says in his research that bank's income can be generated from equity financing profit i, e musyarakah and mudharabah instruments. Profit also can be generated from debt financing activities by using BBAJ AITAB, and murabahah and from money/securities instrument. Non-financing income such as fees, commissions and guarantees and custodial services contribute to the bank's profit. Some muamalat principles such as al-wakalah al-kafalah, ar-rhanu and al-wadiah are applied in services activities.

### IV. KAFALAH AS A HYBRID CONTRACT IN CONTEMPORARY ISLAMIC BANKING AND FINANCE APPLICATION

Hybrid contract in which several contracts are combined in one transaction however it does not come out with a new name of aqd. Yet the name in each aqd stated in the contract and it is practiced on that transaction. For example: qardh and murabahah, or qardh and syirkah al-milk, or qardh and ijarah, or qardh and ijarah muntahiyah bi al-tamlik in taking over the financing; Kafalah wa al-ijarah on Islamic credit card and wacad for wakalah wa al-murabahah,

wakālah wa al-ijārah, wakālah wa al-mushārah, and so on in current account (Rekening Koran) and line or overdraft financing facility; wakālah in murābahah financing or called as murābahah bil wakālah and wakālah bil ujah on L/C financing, RTGS, Factoring. In Islamic bank, even the caqd wakālah bil ujah, which majority used in General and Life Islamic Insurance; Kafālah bil ujah on L/C, Bank Guarantee, financing for multi services and multi-use, Islamic credit cards; Mudhārahah wal murābahah, mudhārahah wal ijārah, mudhārahah wal istisnac in linkage program; Hiwālah bil ujah on factoring financing and bay wal ijārah on REPO SBIS and Sukuk; and Qardh, rahn and ijārah in one transaction on the product of gold pawn in Islamic bank according to Dr M. Aatur Rahman and Dr. Md. Golam Mohiuddin in 2014.

#### V. FEE-BASED ISLAMIC BANKING CONTRACTS

Obiyathulla Ismath Bacha says in 2004 that Islamic banks offer these same services through use of a number of items. Short term working capital financing in the form of Murabaha (cost-plus) and trade financing largely thru Bai Bithaman Ajil (deferred sale). In addition Ijarah, Kafalah and Hiwalah facilities of Islamic banks match leasing, Letters of Guarantee (Bank Guarantees) and the Fund transfer services, respectively, of conventional banks.

Moreover, Shahida bt. Shahimi & Abd. Ghafar B. Ismail et al say in another research that in Islamic law, kafalah is the creation of an additional liability with regard to the claim, not to the debt. Bank Negara Malaysia (2004) defines the concept as guarantee provided by a person to the owner of goods, who had placed or deposited his goods with a third party, whereby the guarantor and the third party must meet any subsequent claim by the owner for his goods. In other words, the third party becomes surety for the payment of a debt or obligation, if unmet by the person originally liable. It is similar to a pledge given to a creditor that the debtor will pay the debt, fine or any other liability. The contract of kafalah is capable of becoming the basis of more sophisticated vehicle for a financial intermediary to undertake financial and performance guarantees and underwriting of financial claims, which are integral parts of modern banking and capital markets.

They also say that in Islamic banking, intermediation contracts provide agents with a set of tools to perform financial intermediation and to offer fee-based services for economic activities. The contracts like kafalah (guarantee), amanah (safe keeping), wakalah (agent) and ju'alah (promise/reward) complement the functions of Islamic banks as financial intermediaries by offering services for a fee to facilitate economic activities of consumers, corporate and public sector. For example, on the liabilities side, a bank can offer general custodial services for consumers and corporate (or representative of capital owners who is able to direct the management of investment more closely) in return for fee income. These contracts have not received due attention of researches in the context of their usage in intermediation in spite of their vital role in performing many of the functions which modern financial intermediaries are performing. Through these contracts, other functions of a financial system such as custodial services, brokerage, consulting, guarantees and insurance can be designed.

According to Shahida bt. Shahimi & Abd. Ghafar B. Ismail et al in 2006, the vast potential of fee income at Islamic banks along with the lack of attention given to the underlying contracts of fee income motivate us to examine the factors that may affect the nontraditional activities in these institutions. By doing so, this study contributes to the extant literature by two ways. First, they broaden the study of nontraditional activities in US commercial banks originated by Rogers and Sinkey in 1999 by examining Islamic banks in Malaysia. Second, they introduce the influence of credit risk measured by non-performing loans such as ex-post credit risk, instead of loan loss provision (LLP) used by Rogers and Sinkey in 1999. They find that the LLP is not an accurate or direct measure of credit or default risk on loans offered by banks such as ex-ant credit risk

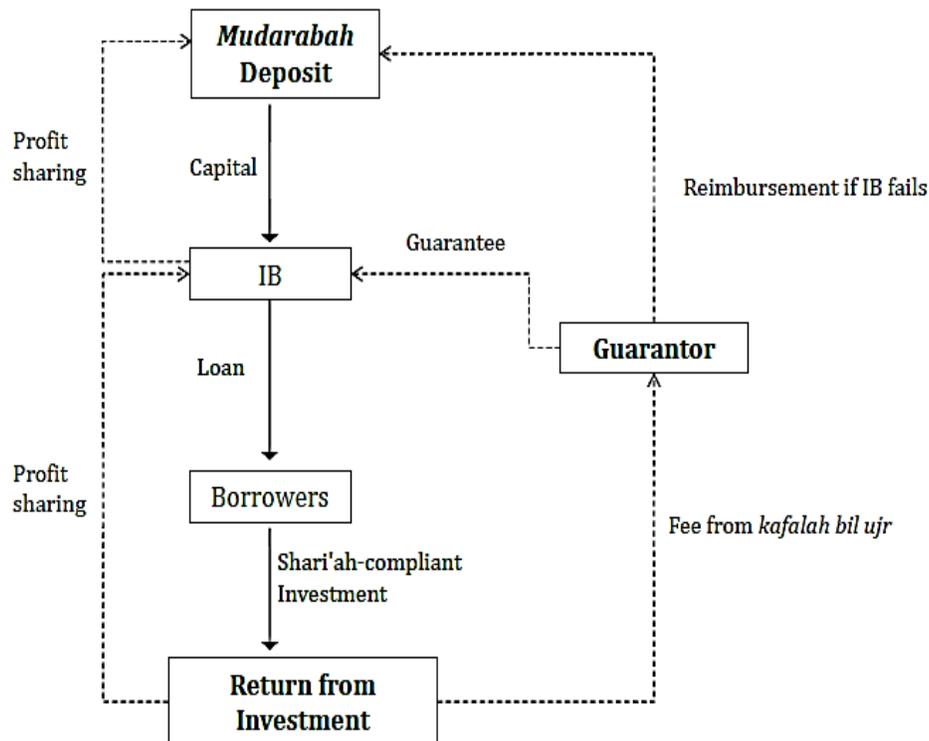
Conventional commercial banks, Islamic banks also offer certain services for which they receive a fee. These include letters of guarantee (kafalah), bills of exchange (hawalah), such as cheques and bankers drafts, and agency services (wakalah) said by Dr M. Aatur Rahman, Dr. Md. Golam Mohiuddin in 2014.

According to Jocelyn Grira, M. Kabir Hassan et al, there are several approaches that a government could take in order to design a Shari'ah compliant deposit insurance system<sup>5</sup>. In this paper we will discuss and consider an Islamic-based contract for our mathematical formulation, which is "guarantee with fee" (kafalah bil ujr). This contract of guarantee with fee is a contractual guarantee given by a guarantor to assume the responsibilities and obligations of the party being guaranteed should claims arise. As consideration for the guarantee, a fee is paid by the guaranteed party to the guarantor, which is similar to deposit insurance premium in conventional finance, but comply with Islamic rules.

They also say that the whole "guarantee with fee" (kafalah bil ujr) process works as follows: Islamic banks accept mudarabah deposits from the investors in a profit-loss sharing mudarabah contract and make loans in profitable and Shari'ah-compliant projects. In this financing agreement, project-owners share the project after tax net-income with Islamic banks if the project is successful, but lose their investment in case of project defaults. To reduce the default

risk and enhance the creditworthiness of the project, the guarantor intervenes by providing financial mudarabah deposit guarantees. If the project turns out to be successful, the guarantor gains the deposit guarantee fee, and Islamic banks and project-owners share the after-tax net-income according to their profit sharing agreements.

This chart below plots the interactions between mudarabah certificate holders, Islamic banks (IB) and the insurer in the arrangement of deposit insurance contracts, “guarantee with fee” (*kafalah bil ujr*). IB initiates investment and requires outside financing in the form of Islamic profit sharing debt. The guarantor intervenes by providing a financial guarantee in order to improve the investment creditworthiness. If the investment is made, each stakeholder receives part of the return generated by the investment. The chart illustrates the cash inflows to and outflows from the investment to the different stakeholders.



**Cash flow chart in deposit insurance contracts (*kafalah bil ujr*)**

### 5.1. Shariah Issue of Charging Fees for Guarantee

According to Dr. Azman Mohd Noor and Muhamad Nasir Haron, the major Shariah issue is the question of whether charging a fee (*kafalah/ guarantee*) is allowable. Among the legal consequences is that all the premiums paid by the member institutions will be treated as considerations for the protection and guarantee of the deposits. In other words, the fees paid by the members are actually compensations against the guarantee. As such, all the accumulated payments belong to PIDM. The Shariah basis for this is *kafalah bi al-ajr*.

### 5.2 Latest Resolution of Shariah Advisory Council BNM

The Shariah Advisory Council of BNM in its 54th meeting held on 27th October 2005 / 23rd Ramadan 1426 and in its 55th meeting held on 29th December 2005 / 27th Zulkaedah 1426, resolved that the above Islamic guarantee (by charging guarantee fee) mechanism provided by the credit guarantee company to the Islamic financial institutions offering Islamic financing products to customers is permissible.

Nevertheless, the SAC of BNM in the 80th meeting, dated 7th January 2009 resolved that PIDM operation in managing insurance for Islamic deposits can be operated based on the principle of *kafalah bi al-ajr*. The premiums paid by the member institutions to PIDM are regarded as *ujrah* or fee for service and as such shall belong to PIDM.

Since it is a compensation for the service (protection), PIDM can structure the charges either at a lump sum payment or by installments.

### *5.3. Juristic Opinions on the Rule Regarding Charging Fees for Guarantee*

The great majority of Islamic jurists have always considered it unlawful to charge a fee for a guarantee. They are the jurists from Hanafites, Shafiites, Malikites and also Hanbalites who claimed that it is unlawful to charge fee against a guarantee. They hold that it is permissible to give guarantee; however, to take any rewards from it is prohibited. There are evidences and justifications that show why such charges are not permissible as follows:

Al-Kafalah is a tabarru contract, however if it is associated with a fee imposed by the guarantor, it becomes a contract of commercial exchange (mu'awadhah) which is not allowable. The condition of charging a fee for a guarantee will amount to uncertainty (gharar) which is unlawful. The guarantor who guarantees the debt of another person for a fee will engage in riba by asking the guaranteed person to pay back more than what he owed which is the debt in full plus the fee for the guarantee.

Ibn Qudamah argues: "The guarantor is obligated to honor the payment of debt, when he pays it, it becomes the obligation of the guaranteed person, and as such it becomes a debt. Hence, if the guarantor takes fee, it becomes a loan which generates profit to the creditor.

In the same vein, Al-Dusuqi of the Malikites argues: "The guarantor when he pays the debt to the lender, he will ask the debtor (under his guarantee) the same amount with addition to the fee. This is not allowable as it is a loan with extra payment.

## VI. ISLAMIC BANKING PRODUCT DEVELOPMENT

A mufawadah partnership is based on wakalah (agency) and kafalah (surety) that entails full commitment from the partners. To achieve this purpose, all partners should maintain equality in capital, labor, liability and legal capacity. It declares each partner to be an agent of and surety for the other. In an 'inan partnership, the equality of legal capacity and contribution by each partner is not necessary according to Muhamad Muda, Abdullaah Jalil.

### *6.1. Meezan Bank's New Deposit Product, Meezan Kafalah*

According to A. Ahmad Siddiqi, H. Qur, Meezan Bank is introducing a unique saving product with Takaful cover which is all ready for "roll-out" with a grand launch. The latest addition to Meezan's bouquet of offerings Meezan Kafalah (MK) is indeed a first in the industry. This product shall be a harbinger for a positive change in the industry leading to moderate sales incentives from the current huge sales incentive trend in Takaful / Insurance industry that is causing sales by deception. Meezan Kafalah has a unique structure where the customer can-

- (i) withdraw all his investment without any deductions at any time, unlike the bancatakaful/ banc insurance where the customer faces hefty erosion of investment in case of withdrawal within the first seven years and
- (ii) The takaful cover contribution shall be made by the Bank on behalf of the customer.

## VII. THE INSTRUMENTS AND BUSINESS MODEL OF MICRO FINANCING IN IMFIS

Dr. M. Ataur Rahman, Dr. Md. Golam Mohiuddin say that Islamic Micro Finance Institution can offer a wide-array of Islamic financial instruments addressing various, needs and demands of the client especially among the micro and small enterprises. Among these instruments are Murabahah (mark-up sale), this contract can be used for sale and purchase an item, such as motorcycle financing, Mudharabah, this contract that can be used for investment in which Islamic bank act as capital provider and the customer acts as an entrepreneur, such as car financing, house financing and so on where the profit divided in accordance with the stipulated agreements while the loss is borne by the capital provider, Musharakah, this contract that can be used for joint venture where Islamic bank act as financier for some business that need for capital injection, Istishna, this contract that can be used for construction of houses to be ordered by the buyer, Ijarah, this contract is used for lease, the lease usually ends with ownership at the end of the period, Wakalah, kafalah, and many more.

## VIII. KAFALAH INVOLVES IN THE RELATIONSHIP BETWEEN THE ISSUER AND THE CARD HOLDER

A. Ahmad Siddiqi, H. Qur says in his paper that Prof. Dr. A.H. Omar explained the view point of Al-Azhar saying: the relationship between the issuer and the Card holder can be resembled to the transaction of Kafalah (guarantee) in Islamic Jurisprudence, due to the following arguments.

*A. Meaning of Kafalah (guarantee)*

The issuing bank guarantees the card holder to the buyer (trader). According to Islamic Jurists Kafalah means the acceptance of responsibility for a gazette right on a person. Law experts also say that the issuer is considered the guarantor of the card holder. Moreover there are three parties involved in a guarantee as the card agreement is held also among three parties.

*B. Guarantee before occurrence of debt*

To consider the card agreement as a guarantee is possible because the Card (guarantee) is issued before the debt occurs. Jurists explain it as guarantee before the existence of debt, as Imam Sirakhsi says, if a person says to the other, "Give something to a person, it is valid" 13. Like this are the quotations of Maliki, Shafee & Humbli Jurists.

*C. Cash Guarantee*

The Bank demands the Card holder to have a balance for a debit card. Although this relationship; appears to be Wakalah (Agency) but it can be Kafalah too as some Hanafi jurists say, if a person takes cash guarantee for a cash debt, it is legitimate 14.

*D. Reception after payment*

The issuer pays first to the buyer then gets back his money from the card holder. This pattern has been illustrated in jurist's examples that guarantor has no right to demand money before payment.

*E. Credit line*

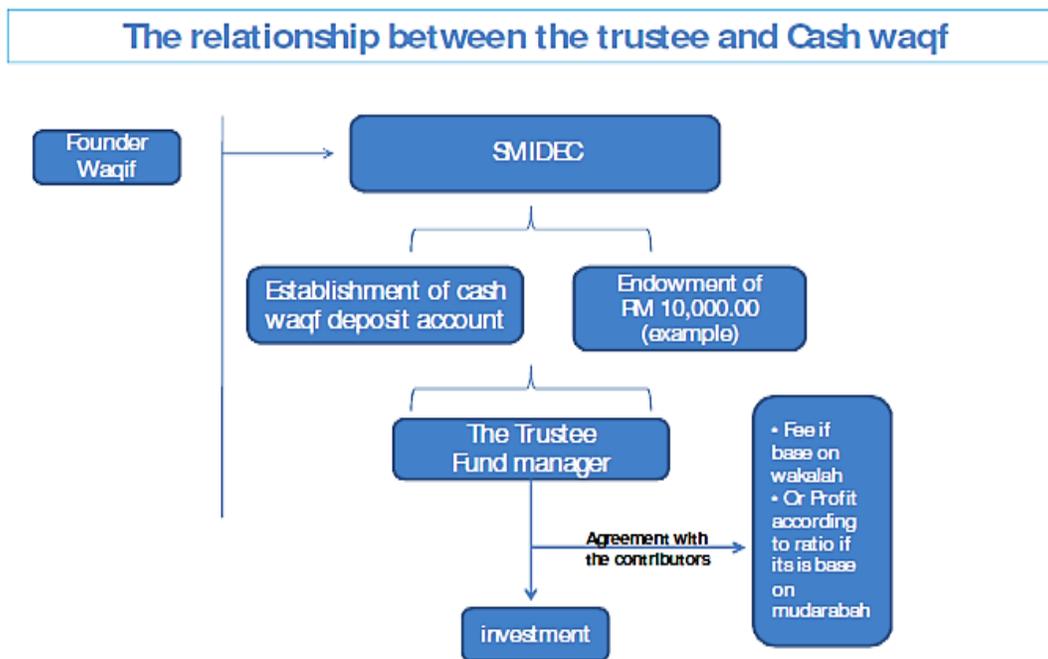
The issuer bank gives the Card holder a credit line to which he can purchase goods or get cash. This behavior also has been mentioned in jurists quotations like, "If a person says that he is responsible of a debt of (1-10 Dirhams) for someone, so it is an acceptable.

*F. Right of Card Cancellation*

The Bank reserves the right to cancel the card anytime. Jurists allow for that saying, "The guarantor has the right to withdraw his guarantee and he is the guarantor only for the transaction completed".

**IX. THE RELATIONSHIP BETWEEN THE TRUSTEE AND THE CASH ENDOWMENT ACCOUNT**

The relationship between the fund manager or operator and the cash waqf endowment account is based on mudarabah or wakalah concept, therefore the fund manager will be sharing profit according to ratio agreed up front, the relationship can be similar to takaful operators in Islamic insurance. However if the concept is based on kafalah the fund manager will be entitled for fee according to Abdul Ghafar Ismail Mohd Ezani Mat Hassan Norazman Ismail Shahida Shahimi



#### X. KAFALAH AND RIBA

Monzer Kahf says in 2006 that if risk taking justifies return the Kafalah, which is a case of extreme risk taking, must be most rewarding in terms of return. But it is known, in Shari'ah as declared by the OIC Islamic Fiqh Academy's resolutions that a reward on Kafalah is more prohibited than Riba because it amounts to an increment on a promise to give a loan while Riba is an increment on an actually given loan.

#### XI. KAFALAH AND TAKAFUL

Zia Ahmed says in his research that in case of Takaful, every individual survives under the kafalah (guarantee or surety-ship) of the group. Takaful will provide cover to all entrepreneurs and individuals in the society against the spiritual and material losses. In primitive society, people lived together in form of families or tribe, where their needs were fully met and protected, through cooperation and mutual help. Consequently, they were fully protected against all sorts of losses. It was the old method of insurance.

#### XII. KAFALAH PROGRAM

According to Abdulhameed Al-Khateeb, Ahmad Faloudah, Moayd Bahumayd and Aasim Zafar in 2015, Kafalah is a Saudi program that supports small and medium enterprises by introducing loans for them to improve gross domestic product and provide job opportunities for increasing employment. This program contributes in development of Saudi society in the whole regions of KSA. The beneficiaries from loans have invested in different fields, construction, property, and trade or even in stocks which has reflected a positive impact on Saudi economy.

#### XIII. RECOMMENDATION & CONCLUSION

According to Dr. Azman Mohd Noor and Muhamad Nasir Haron, as far as Takaful Benefit Protection scheme is concerned, it is suggested that the premiums payable to PIDM is directly borne by the Takaful Risks Fund which represents contributions of all participants for their mutual help and indemnification which is realized through takaful benefits. Therefore, the guarantee and protection actually come from the risk fund performed by Takaful operator on behalf of the fund. The takaful contractual relation clearly defines the position of the operator which is only an agent (wakeel), not a guarantor. The usage of kafalah as a fiqh adaptation for absolute assignment is not contrary to Shariah. Kafalah itself is a recognized contract in Islamic transaction. Kafalah literally is assurance; its original meaning is related to joining and commitment. Ahmad Basri Ibrahim and Ahmad Fadhil Hamdi Mohd Ali

say in 2015 that Bank Negara Malaysia in its Kafalah Concept Paper defines kafalah as a contract where the guarantor (kafil) conjoins the guaranteed party (makful 'anhu) in assuming the latter's specified liability. To conclude, the protection of takaful benefit is justified for the benefits of the takaful participants and for a prudent and robust Islamic financial system. But as far as Shariah compliance is concern, the structure of kafalah bi al-ajr contract perhaps needs reconsideration since it may look like conventional insurance model. The possible alternative is takaful tabarru model.

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# Solving Multi-objective Generalized Solid Transportation Problem by IFGP approach

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## Abstract

In this paper multi objective generalized solid transportation problem (MOGSTP) has been considered. All the objective functions are to be optimized under same restrictions. Normally the objectives are conflicting in nature, otherwise by solving any one of them we can find positive optimum solution of positive problem. The problem has been solved by interactive fuzzy goal programming (IFGP) approach. This approach is to focus on minimizing the upper bound of the costs of each objective functions to obtain a compromising solution which is closed to the lower bound of the respective objective functions. A numerical example also presented.

*Key words* : Generalized solid transportation problem; Multi objective transportation problem; Fuzzy programming; Linear membership function.

Mathematics Subject Classification : 90B06, 90C08.

## 1 Introduction

Decision making is a critical process. The best decision among the several alternatives depends on the decision maker. There are several restrictions. All of them may or may not be in the same priority level, in any organisation. Decision on a single criteria may not sufficient for a practical problem rather consideration of multiple criteria makes the proposition more feasible. In general, the real life problems are modeled with multi-objectives which are measured in different scales and at the same time in conflict. The decision will be optimized (maximized or minimized) on the basis of one or more objectives under the same restrictions. These situations arise in transportation areas [15, 16, 21, 25].

There are many existing methods to solve multi object transportation problem. Some of them are

- i. Interactive method
- ii. Non interactive method
- iii. Goal programming method

iv. Fuzzy programming method

## 1.1 Interactive method

In this method decision maker is directly involved to find the efficient solutions and then best compromise-solution is chosen. But for large scale problem it is difficult to evaluate all the efficient solutions. Several authors studied in this method [8, 18, 20, 23].

## 1.2 Non interactive method

In this method, firstly the decision maker enumerates all the efficient solutions which is a long process. Then take the final decision. But limitations come from the in-experience and incomplete information of decision makers. Several authors studied in this process [9, 12, 13].

## 1.3 Goal programming

This technique is very useful tool to solve multi objective programming. Many researchers solve in this method [4, 7, 11, 12, 23]. But for setting of weights to different goal plays a vital role. Otherwise it gives inefficient solution.

## 1.4 Fuzzy programming method

In solving Multi object transportation problem, fuzzy set theory has wide applications. It is a powerful tool for incomplete preference or information of decision maker. In this method the problem is characterized by fuzzy membership functions. There are many types of such fuzzy membership functions. Several authors studied in this way [1, 2, 4, 6, 10, 17, 24].

There are many real world problems such as routing problem, machine assignment problem, inventory problem, aircraft routing problem are very close to generalized transportation problem. Generalized transportation problem has studied by several authors [3, 5, 14, 19].

In this paper, we have used interactive fuzzy goal programming (IFGP) technique to solve the general multiple objectives generalized solid transportation problem. If the decision maker is satisfied by the outcome, iteration is stopped else interactive procedure applies to find compromising solution. In section 2, we formulated the problem and some relevant definition has also been given. In section 3.1, solution procedure has been developed. Algorithm is presented in section 4. Also in Section 5, presents the numerical example to test the validity of the approaches.

## 2 Problem formulation of MOGSTP

Let there be  $l$  origins,  $m$  destinations and  $n$  products in a generalized solid multi objective transportation problem.  $x_{ijk}$  = the amount of  $k^{th}$  type of product transported from the  $i^{th}$  origin to the  $j^{th}$  destination,  $r_{ijk}^p$  =  $p^{th}$  type of cost involved in transporting per unit of  $k^{th}$  type product from  $i^{th}$  origin to  $j^{th}$  destination, therefore they are positive quantities by nature,  $a_i =$

the number of units available at the  $i^{th}$  origin;  $1 \leq i \leq l$ ,  $b_j$  = the number of units required at the  $j^{th}$  destination;  $1 \leq j \leq m$ ,  $c_k$  = requirement of the number of units of  $k^{th}$  product;  $1 \leq k \leq n$ , And  $d_{ijk}^1, d_{ijk}^2$  = positive constants other than unity.

The cost minimizing multi objective generalized transportation problems is:

$$\text{Min } Z^p(x) = \sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk}; \quad \text{for } 1 \leq p \leq P \quad (2.1)$$

Subject to constraints,

$$\sum_{j=1}^m \sum_{k=1}^n d_{ijk}^1 x_{ijk} \leq a_i; \quad 1 \leq i \leq l, \quad (2.2)$$

$$\sum_{i=1}^l \sum_{k=1}^n x_{ijk} = b_j; \quad 1 \leq j \leq m, \quad (2.3)$$

$$\sum_{i=1}^l \sum_{j=1}^m d_{ijk}^2 x_{ijk} \leq c_k; \quad 1 \leq k \leq n, \quad (2.4)$$

and  $x_{ijk} \geq 0$  for  $1 \leq i \leq l, 1 \leq j \leq m, 1 \leq k \leq n$ ,

Where at any destination  $j$ , we allocate the amount  $x_{ijk}$ , then the permissible amount from origin  $i$  is  $d_{ijk}^1 x_{ijk}$  and the permissible  $k^{th}$  type of product is  $d_{ijk}^2 x_{ijk}$ .

There are some special character in generalized solid transportation problem. They are stated below:

1. The rank of the co-efficient matrix of  $[x_{ijk}]$  are in general  $l + m + n$  rather than  $l + m + n - 2$ , i.e. all the constraints are in general independent.
2. The integrability property of  $x_{ijk}$  may not be hold in generalized transportation problem.
3. The activity vector is  $r_{ijk}^p = d_{ijk}^1 e_i + e_{l+j} + d_{ijk}^2 e_{l+m+k}$ , whereas in classical transportation problem, it is  $r_{ijk}^p = e_i + e_{l+j} + e_{l+m+k}$ .
4. In generalized transportation problem, it need not be true that cells corresponding to a basic solution form a tree. Or in other words, the vectors in the loop are linearly independent. The vectors in the loop are in general independent.

**Definition 2.1. Non-dominated solution:** A feasible vector  $x^0 \in S$  ( $S$  is the feasible region) yields a non-dominated solution, if and only if, there is no other vector  $x \in S$  such that  $\sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk} \leq \sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk}^0$  for all  $p$  and  $\sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk} < \sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk}^0$  for some  $p, p = 1, 2, \dots, P$ .

**Definition 2.2. Efficient solution:** A point  $x^0 \in S$  is efficient if there does not exist another  $x \in S$  such that  $\sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk} \leq \sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk}^0 \quad \forall p$  and  $\sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk} < \sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk}^0$  for some  $p$ . Otherwise  $x^0$  is an inefficient solution. For example  $x^0 \in S$  is efficient if its criterion vector is not dominated by the criterion vector of another point in the feasible region  $S$ .

**Definition 2.3. Compromise solution:** A feasible vector  $X^* \in S$  is called a compromise solution iff  $X^* \in E$  and  $Z(X^*) \leq \Lambda X \in SZ(X)$ , Where  $\Lambda$  stands for "minimum and  $E$  is the set of efficient solutions.

This definition imposes two conditions on the solution for it to be a compromise solution. First, the solution should be efficient. Second, the feasible solution vector  $X^*$  should have the minimum deviation from the ideal point than any other point in  $S$ . Simply put, the compromise solution is the closest solution to the ideal one that maximizes the underlying utility function of the decision maker.

In real-world cases, knowledge of the set of efficient solutions  $E$  is not always necessary. On the other hand, the decision makers preferences are to be considered in determining the final compromise solution.

**Definition 2.4. Preferred compromise solution:** *If the compromise solution satisfies the decision makers preferences, then the solution is called the preferred compromise solution.*

**Definition 2.5. Membership function:** *A real fuzzy number  $\tilde{\alpha} = (\alpha_1, \alpha_2, \alpha_3, \alpha_4)$  where  $\alpha_1, \alpha_2, \alpha_3, \alpha_4 \in R$  and two functions  $f(x), g(x) : R \rightarrow [0, 1]$ , where  $f(x)$  is non decreasing and  $g(x)$  is non increasing, such that we can define membership function satisfy the following conditions*

$$\mu_{\tilde{\alpha}}(x) = \begin{cases} f(x) & \text{for } \alpha_1 \leq x \leq \alpha_2 \\ 1 & \text{for } \alpha_2 \leq x \leq \alpha_3 \\ g(x) & \text{for } \alpha_3 \leq x \leq \alpha_4 \\ 0 & \text{otherwise} \end{cases}$$

### 3 Solution procedure of MOGSTP

From the proposed problem, we first solve the single objective generalized solid transportation problem for  $p = 1, 2, \dots, P$  as follows. The cost minimizing objective function of the solid transportation problem is

$$\text{Min } Z^p(x) = \sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n r_{ijk}^p x_{ijk}; \quad 1 \leq p \leq P \tag{3.1}$$

Subject to constraints,

$$\sum_{j=1}^m \sum_{k=1}^n d_{ijk}^1 x_{ijk} \leq a_i; \quad 1 \leq i \leq l, \tag{3.2}$$

$$\sum_{i=1}^l \sum_{k=1}^n x_{ijk} = b_j; \quad 1 \leq j \leq m, \tag{3.3}$$

$$\sum_{i=1}^l \sum_{j=1}^m d_{ijk}^2 x_{ijk} \leq c_k; \quad 1 \leq k \leq n, \tag{3.4}$$

and  $x_{ijk} \geq 0$  for  $1 \leq i \leq l, 1 \leq j \leq m, 1 \leq k \leq n,$

Now we find the lower bound  $L_p$  and upper bound  $U_p$  for the  $p^{th}$  (where  $1 \leq p \leq P$ ) objective function  $Z^p$  and  $d_p = U_p - L_p$  (where  $1 \leq p \leq P$ ) the degradation allowance for objective  $p$ .

### 3.1 IFGP approach for solving MOGSTP

We now define the membership function of general multiple objective solid transportation problem as:

$$\mu_p = \begin{cases} 1 & \text{for } Z^p \leq L_p \\ \frac{U_p - Z^p}{U_p - L_p} & \text{for } L_p < Z^p < U_p \\ 0 & \text{for } Z^p \geq U_p \end{cases}$$

By using an auxiliary variable  $\lambda$  the above fuzzy model can be converted into the following crisp model as.

$$\text{Maximize } \lambda \tag{3.5}$$

Subject to constraints

$$Z^p + \lambda(U_p - L_p) \leq U_p; \quad 1 \leq p \leq P \tag{3.6}$$

$$\text{And } \sum_{j=1}^m \sum_{k=1}^n d_{ijk}^1 x_{ijk} \leq a_i; \quad 1 \leq i \leq l, \tag{3.7}$$

$$\sum_{i=1}^l \sum_{k=1}^n x_{ijk} = b_j; \quad 1 \leq j \leq m, \tag{3.8}$$

$$\sum_{i=1}^l \sum_{j=1}^m d_{ijk}^2 x_{ijk} \leq c_k; \quad 1 \leq k \leq n, \tag{3.9}$$

$$\text{and } x_{ijk} \geq 0 \quad \text{for } 1 \leq i \leq l, 1 \leq j \leq m, 1 \leq k \leq n,$$

## 4 Algorithm

The solution procedure can be presented in the following steps

Step 1: Solve each of the  $Z^p(x)$  for  $1 \leq p \leq P$  as a single objective solid transportation problem.

Step 2: The solutions identify all the solution  $X^p$ ;  $1 \leq p \leq P$  if  $X^p$  for  $1 \leq p \leq P$  are same then any one of  $X^p$  ( $1 \leq p \leq P$ ) be the optimal solution and go to step 8.

Step 3: Evaluate best lower bound  $L_p$ ; ( $1 \leq p \leq P$ ) and worst upper bound  $U_p$ ; ( $1 \leq p \leq P$ ).

Step 4: Define fuzzy membership function

$$\mu_p = \begin{cases} 1 & \text{for } Z^p \leq L_p \\ \frac{U_p - Z^p}{U_p - L_p} & \text{for } L_p < Z^p < U_p \\ 0 & \text{for } Z^p \geq U_p \end{cases}$$

Step 5: Convert into crisp linear programming problem.

$$\text{Max } \lambda \tag{4.1}$$

Such that

$$Z^p + \lambda(U_p - L_p) \leq U_p; \quad 1 \leq p \leq P \tag{4.2}$$

And 
$$\sum_{j=1}^m \sum_{k=1}^n d_{ijk}^1 x_{ijk} \leq a_i; \quad 1 \leq i \leq l, \tag{4.3}$$

$$\sum_{i=1}^l \sum_{k=1}^n x_{ijk} = b_j; \quad 1 \leq j \leq m, \tag{4.4}$$

$$\sum_{i=1}^l \sum_{j=1}^m d_{ijk}^2 x_{ijk} \leq c_k; \quad 1 \leq k \leq n, \tag{4.5}$$

and  $x_{ijk} \geq 0$  for  $1 \leq i \leq l, 1 \leq j \leq m, 1 \leq k \leq n,$

And let the solution is  $X^*$

Step 6: If the decision maker is satisfies with this solution then stop and this is the solution  $X^*$  of multiple objective transportation problem. Otherwise go to step 7.

Step 7: Set  $U_p = Z^p(X^*)$  and go to step 3 until decision maker satisfies or the problem terminates.

Step 8: Stop.

## 5 Numerical Example

Let us consider the following example to establish our method of approach.

$$\begin{aligned} \text{Min } Z^1 &= 0.5x_{111} + 0.4x_{112} + 0.8x_{121} + 0.5x_{122} + 0.25x_{131} + 0.2x_{132} + 0.3x_{211} + \\ & \quad 0.5x_{212} + 0.5x_{221} + 0.2x_{222} + 0.7x_{231} + 0.1x_{232}; \end{aligned}$$

$$\begin{aligned} \text{Min } Z^2 &= 0.8x_{111} + 0.4x_{112} + 0.2x_{121} + 0.25x_{122} + 0.25x_{131} + 0.8x_{132} + 0.1x_{211} + \\ & \quad 0.1x_{212} + 0.1x_{221} + 0.6x_{222} + 0.8x_{231} + 0.8x_{232}; \end{aligned}$$

$$\begin{aligned} \text{Min } Z^3 &= 0.9x_{111} + 0.2x_{112} + 0.5x_{121} + 0.5x_{122} + 0.8x_{131} + 0.7x_{132} + 0.9x_{211} + \\ & \quad 0.5x_{212} + 0.2x_{221} + 0.5x_{222} + 0.9x_{231} + 0.8x_{232}; \end{aligned}$$

$$\begin{aligned} \text{Min } Z^4 &= 0.1x_{111} + 0.4x_{112} + 0.1x_{121} + 0.5x_{122} + 0.9x_{131} + 0.5x_{132} + 0.6x_{211} + \\ & \quad 0.2x_{212} + 0.8x_{221} + 0.8x_{222} + 0.5x_{231} + 0.1x_{232}; \end{aligned}$$

Subjectto

$$\begin{aligned} 0.4x_{111} + 0.6x_{112} + 0.5x_{121} + 0.4x_{122} + 0.2x_{131} + 0.4x_{132} &\leq 230; \\ 0.25x_{211} + 0.6x_{212} + 0.2x_{221} + 0.4x_{222} + 0.4x_{231} + 0.5x_{232} &\leq 650; \\ x_{111} + x_{112} + x_{211} + x_{212} &= 200; \\ x_{121} + x_{122} + x_{221} + x_{222} &= 600; \\ x_{131} + x_{132} + x_{231} + x_{232} &= 300; \\ 0.2x_{111} + 0.7x_{121} + 0.5x_{131} + 0.2x_{211} + 0.5x_{221} + 0.3x_{231} &\leq 300; \\ 0.5x_{112} + 0.6x_{122} + 0.3x_{132} + 0.4x_{212} + 0.5x_{222} + 0.7x_{232} &\leq 1010; \end{aligned}$$

Table 1:

	$Z^1$	$Z^2$	$Z^3$	$Z^4$
$X^1$	210	620	720	630
$X^2$	475	200	550	700
$X^3$	438	380	373	700
$X^4$	519	435	640	238
$L_p$ =lower bound	210	200	373	238
$U_p$ =upper bound	519	620	720	700
$d_p = U_p - L_p$	309	420	347	462

The corresponding objective functions values are

The membership functions of the objective functions based on membership function (MF) formula are as follows:

$$\text{Max } \lambda$$

Subject to

$$0.5x_{111} + 0.4x_{112} + 0.8x_{121} + 0.5x_{122} + 0.25x_{131} + 0.2x_{132} + 0.3x_{211} + 0.5x_{212} + 0.5x_{221} + 0.2x_{222} + 0.7x_{231} + 0.1x_{232} + \lambda 309 \leq 519;$$

$$0.8x_{111} + 0.4x_{112} + 0.2x_{121} + 0.25x_{122} + 0.25x_{131} + 0.8x_{132} + 0.1x_{211} + 0.1x_{212} + 0.1x_{221} + 0.6x_{222} + 0.8x_{231} + 0.8x_{232} + \lambda 420 \leq 620;$$

$$0.9x_{111} + 0.2x_{112} + 0.5x_{121} + 0.5x_{122} + 0.8x_{131} + 0.7x_{132} + 0.9x_{211} + 0.5x_{212} + 0.2x_{221} + 0.5x_{222} + 0.9x_{231} + 0.8x_{232} + \lambda 347 \leq 720;$$

$$0.1x_{111} + 0.4x_{112} + 0.1x_{121} + 0.5x_{122} + 0.9x_{131} + 0.5x_{132} + 0.6x_{211} + 0.2x_{212} + 0.8x_{221} + 0.8x_{222} + 0.5x_{231} + 0.1x_{232} + \lambda 462 \leq 700;$$

$$0.4x_{111} + 0.6x_{112} + 0.5x_{121} + 0.4x_{122} + 0.2x_{131} + 0.4x_{132} \leq 230;$$

$$0.25x_{211} + 0.6x_{212} + 0.2x_{221} + 0.4x_{222} + 0.4x_{231} + 0.5x_{232} \leq 650;$$

$$x_{111} + x_{112} + x_{211} + x_{212} = 200;$$

$$x_{121} + x_{122} + x_{221} + x_{222} = 600;$$

$$x_{131} + x_{132} + x_{231} + x_{232} = 300;$$

$$0.2x_{111} + 0.7x_{121} + 0.5x_{131} + 0.2x_{211} + 0.5x_{221} + 0.3x_{231} \leq 300;$$

$$0.5x_{112} + 0.6x_{122} + 0.3x_{132} + 0.4x_{212} + 0.5x_{222} + 0.7x_{232} \leq 1010;$$

Using Lingo 15 optimizing software,

We get,  $\lambda = 0.4474208$ ,

$$Z^1 = 381, Z^2 = 432, Z^3 = 565, Z^4 = 493.$$

If the decision maker needs more improvement, then, further iteration may be performed.

## 6 Conclusion

Nothing new will be discussed if the constraints

$$\sum_{i=1}^m \sum_{k=1}^q x_{ijk} = b_j; \quad 1 \leq j \leq n,$$

is changed into

$$\sum_{i=1}^m \sum_{k=1}^q d_{ijk}^3 x_{ijk} = b_j; \quad 1 \leq j \leq n,$$

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# Site specific delivery of anti-arthritic drug by gelatin surface modified bovine serum albumin microspheres

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## ABSTRACT

Non-steroidal anti-inflammatory drugs are the most commonly used and widely prescribed drugs all over the world. With the wide advantages they are also associated with severe Gastro-Intestinal side effects. Developments of novel drug delivery systems have always been a challenge to formulation scientists because of their high instability and economic factor compared to the conventional dosage forms. Thus the main objective of the present investigation was to develop gelatin surface modified bovine serum albumin microspheres containing anti-arthritic drug and to evaluate its potential as targeted drug delivery system. Hence there is a prolonged release of the drug along with minimized side effects. A brief overview of the methods developed for the preparation of albumin microspheres and the most suitable techniques for optimum entrapment of drug is emphasized. The in-vitro evaluations are also explained. In order to appreciate the medical application possibilities of albumin microspheres in novel drug delivery, some fundamental aspects are also briefly discussed.

**Keywords:** Site specific drug delivery, gelatin surface modified Bovine serum albumin microspheres, Aceclofenac.

## Introduction

Development of new drug molecule is expensive and time consuming. Improving safety efficacy ratio of "old" drugs has been attempted using different methods such as individualizing drug therapy and therapeutic drug monitoring. Delivering drug at controlled rate, slow delivery, and targeted delivery are other very attractive methods that have been pursued very vigorously (Patel *et al.*, 2009, Jain *et al.*, 2001).

For drugs with short half-lives and with a clear relationship between concentration and response, it will be necessary to dose at regular, frequent intervals in order to maintain the concentration within the therapeutic range. Higher doses at less frequent intervals will result in higher peak concentrations with the possibility of toxicity. For some drugs with wide margins of safety, this approach may be satisfactory (Tripathi *et al.*, 2003).

A trend in NSAID development has been to improve therapeutic efficacy and reduce the severity of upper GI side effects through altering dosage forms of NSAIDs by modifying release of the formulations to optimize drug delivery.

These formulations are designed to increase patient compliance through a prolonged effect and to reduce adverse effects through lowered peak plasma concentrations. Many controlled-release dosage forms are designed to release the drug at a predetermined rate, thus maintaining relatively constant drug levels in the plasma for an extended period of time.

Several benefits may result from the use of such formulations. Reduction of frequency of dosing, lowered adverse effects, and improved patient compliance are considered the primary advantages of controlled-release dosage forms (Sam *et al.*, 2008).

Further, currently available slow release oral dosage forms, such as enteric coated/ double-layer tablets which release the drug for 12-24 hours still result in inefficient systemic delivery of the drug and potential gastrointestinal irritation. Therefore, currently available slow release oral dosage forms of NSAIDs induces systemic effects and the drug is not efficiently used at the site of inflammation (Lewis *et al.*, 1992)

Formulations can affect the safety of preparations by controlling the rate of release of the drug at sensitive sites, by delivering drug to specific sites to minimize systemic exposure, or delivering drug in such a way so as to change the rate or extent of the formation of toxic metabolite (Lachman *et al.*, 1991).

One such formulation uses polymeric microspheres as carriers of drugs. Many authors have reported that nanoparticles and micro particles have a tendency to accumulate in the inflamed areas of the body. It has been reported that microspheres of NSAIDs reduce the GI toxic effects and exhibit sustained action, thus increasing patient and therapeutic compliance.

## 1.1 Microspheres

Microspheres can be described as small particles (in 1-1000 micrometer size range) for use as carriers of drugs and other therapeutic agents. The term microspheres describe a monolithic spherical structure with the drug or therapeutic agent distributed throughout the matrix either as a molecular dispersion or as a dispersion of particles.

Microspheres are used as targeted drug delivery system due to; small size and relatively narrow size distribution which provide biological opportunities for site-specific drug delivery, controlled release of active drug over a long period can be achieved and surface modification can easily be accomplished and hence can be used for site specific drug delivery system (Liggins *et al.*, 2004, Vyas *et al.*, 2002).

The present study is an attempt to develop extended release formulation of Aceclofenac to addresses the above issues.

The objectives for the present study are –

1. To identify formulation excipients based on compatibility studies.
2. To Optimize formulation and processing parameters (Stirring speed, Viscosity of oil phase and Percentage of emulsifying agent, etc.) using optimization technique (Response Surface Methodology) to get the desired response (particle size, entrapment efficiency and drug release). To predict the optimized formulation based on the desired response obtained.
3. To prepare the Aceclofenac microspheres based on predicted optimized formulation. To evaluate the product through various in-vitro (entrapment efficiency, surface characteristics, particle size, drug release & stability) studies.

A number of novel drug delivery systems have emerged encompassing various routes of administration, to achieve controlled and targeted drug delivery, micro-carriers being one of them. These micro-carriers include microspheres, liposomes, nanoparticles, resealed erythrocytes, and micro emulsion etc.

Microspheres have large surface area on which ligands can be attached for delivering drugs to a specific local area. Modification of microsphere surface with specific ligands have been attempted to use these microsphere as targeted drug delivery system.

Gelatin has a specific interaction with fibronectin. Gelatin microspheres have been investigated and demonstrated to target S-180 mouse sarcoma cells (pathological tissue), which are known to express extra fibronectin on their surface. This results in the cell line's extra fibronectin creating an affinity between cancer cells and gelatin microspheres.

Excess fibronectin in the local tissues is associated with a number of disease states, such as inflammatory disorders, cardiovascular disease, rheumatoid arthritis, and cancer. Consequently, gelatin surface modified microspheres may be useful as a targetable controlled-release microsphere system. These microspheres are intended for localized delivery to fibronectin enriched pathological tissues.

*Thus the objective of the present investigation was to develop gelatin surface modified bovine serum albumin microspheres containing anti-arthritic drug and to evaluate its potential as targeted drug delivery system in vivo.*

**Drug:-** Aceclofenac is one of the well tolerated COX-2 inhibitor and is often the drug of choice in the treatment of osteoarthritis, rheumatic arthritis and other related conditions. However, because of its short half-life (2-4 hrs.) it requires dosing of 100 mg twice daily. Missing of dose, which is often common, would cause inconsistency in drug level in the blood, which would in turn reflect in poor therapeutic outcome.

It has been reported that more than 50% of patients fail to take medicine as advised. Extended release formulations are the tools useful in promoting medication adherence and improving therapeutic outcomes. Medication adherence in chronic conditions like arthritis improves the quality of life of the patients.

## MATERIALS AND METHODS

### METHOD OF PREPARATION

#### 3.4.1 Selection of method

Following two methods were investigated for the preparation of BSA microspheres:

##### 3.4.1.1 Emulsion chemical cross-linking

100 mg of bovine serum albumin (BSA) was dissolved in 5 ml of distilled water. Tween-80 was added at a concentration of 2% wt/wt. 20 mg of finely powdered Aceclofenac was added to the above solution and sonicated to obtain a uniform dispersion. One milliliter of this dispersion was injected (drop by drop) into a mixture of 20 ml of heavy liquid paraffin and 1.0 ml of span-85, while stirring at 2000 rpm. Stirring was continued for 10 minutes to obtain a water/oil (w/o) emulsion. One milliliter of 25% w/v glutaraldehyde was added into the emulsion to cross-link the albumin present in the internal phase of the emulsion. Microspheres formed were then separated by centrifugation (8000 rpm for 15 minutes) and washed with 30 ml of petroleum ether to remove liquid paraffin. The microspheres were then suspended in 10 ml of 5% wt/vol. sodium bisulphite solution and stirred on a magnetic stirrer for 10 minutes to remove the residual glutaraldehyde. Finally, the microspheres were washed with distilled water until they were free from residual glutaraldehyde. The microspheres were dried at room temperature and stored in a desiccator (Thakkar H, *et al.*, 2005)

##### 3.4.1.2 Emulsification-heat stabilization technique

10 mg of aceclofenac was added to a 5% w/v solution of BSA containing 0.1% Tween 80 and used as the aqueous phase. The oil phase composed of 30 ml maize oil and 10 ml petroleum ether with 1% Span 80 as emulsifier were stirred for 10 min at 1000 rpm. The aqueous phase was added drop wise to the oil phase and stirred at 1000 rpm for 30 min to form the initial emulsion. This

emulsion was then added to 40 ml of maize oil preheated to 120° C and stirred at 1000 rpm for 15 min to allow the formation of microspheres. The microsphere suspension was centrifuged at 3500 rpm for 30 min and the settled microspheres were washed three times with 50 ml ether to remove traces of oil. The microspheres were dried in a desiccator overnight and stored (Tabassi SAS, *et al.*, 2003).

**Table 3.4 Selection of method**

Batch	Method	Average Particle size (µm)	Shape
M1	Emulsion polymerization chemical cross-linking	15-30	Spherical
M2	Emulsion polymerization heat stabilization	20-40	Spherical

Emulsification polymerization technique was selected as a method of choice as it showed better formulation results when compared to heat stabilization method.

**3.4.2 FORMULATION COMPOSITION**

**Table 3.4.2 Microspheres Formulations**

Formulation	EXPERIMENTAL CONDITION					
	Stirring rate (rpm)	BSA concentration (mg)	Drug (mg)	Surfactant concentration (%)		Glutaraldehyde concentration
				Tween 80	Span 85	
BM-1	1500	400	100	0.5	1	1
BM-2	1500	500	100	0.75	1.25	1.5
BM-3	1500	600	100	1	1.5	2.0
BM-4	2000	400	100	0.75	1.25	2.0
BM-5	2000	500	100	1	1.5	1.0
BM-6	2000	600	100	0.5	1	1.5
BM-7	2500	400	100	1	1.5	1.5
BM-8	2500	500	100	0.5	1	2.0
BM-9	2500	600	100	0.75	1.25	1.0

**3.5 GELATIN SURFACE MODIFICATION**

Gelatin surface modified BSA microspheres (GBM) were prepared by the adsorption of the gelatin onto the BSA microsphere. 10 mg microspheres were dispersed in gelatin solution (2% w/v) at room temperature. After 4 hours the microspheres were collected by centrifugation at 4000 rpm for 15 minutes (Tsong MJ, *et al.*, 2001).

**EVALUATION OF MICROSPHERES**

**3.6.1 Morphology/Electron microscopy**

The morphological study of microspheres was done by Scanning Electron Microscopy (SEM.) (Tuncay M, *et al.*, 2000).

**3.6.2 Particle size**

Average particle size of microspheres was measured by optical microscopy (Jahanshahi M, *et al.*, 2008).

**3.6.3 Drug loading and drug entrapment efficiency**

20 mg of BSA microspheres (BM) were accurately weighed and transferred into a volumetric flask containing 10 ml of methanol. The dispersion was shaken for 12 hours on mechanical shaker. The resultant solution was filtered through whatman filter paper and absorbance was determined spectroscopically using UV-VIS Spectrophotometer (Shimadzu) at 277.0 nm. The concentration of drug was determined from the calibration curve (figure 3.4). The drug loading and entrapment was calculated by the following equation (Sahin S, *et al.*, 2002,

Amount of drug in supernatant

$$\% \text{ Drug loading} = \frac{\text{Amount of drug in supernatant}}{\text{Amount of drug} + \text{amount of excipient}} \times 100 \dots \dots \dots (1)$$

$$\% \text{ Drug Entrapment Efficiency} = \frac{\text{Amount of drug added} - \text{Amount of drug in supernatant}}{\text{Amount of drug added}} \times 100 \dots \dots (2)$$

**3.6.4 Determination of gelatin surface modification**

Gelatin surface modification was estimated by Bradford dye assay method. The Bradford dye assay is based on the equilibrium between three forms of Coomassie Blue G dye. Under strongly acid conditions, the dye is most stable as a doubly-protonated red form. Upon binding to protein, however, it is most stable as an unprotonated, blue form.



**3.6.5 In-vitro drug release study**

*In-vitro* drug release study of aceclofenac from BSA and gelatin surface modified BSA microspheres was carried out for up to 24 hrs using dissolution test apparatus (paddle method) containing 900 ml of phosphate buffer saline (PBS) pH 6.8 as dissolution medium. Microspheres equivalent to 20 mg aceclofenac were kept in muslin cloth and tied to the paddles, stirred at 100 rpm. At various time periods (0.25-24hrs), 5 ml of the sample solutions were withdrawn and diluted with methanol up to 10 ml. An equivalent volume of fresh buffer was added into the dissolution medium. The quantity of drug was estimated against reagent blank by UV spectroscopy at 277.0 nm (Jayaprakash S, *et al.*, 2009).

### 3.7 KINETIC MODELING OF DISSOLUTION PROFILES

In vitro dissolution has been recognized as an important element in drug development under certain assessment of Bioequivalence. Several theory kinetic model describe drug dissolution from immediate and modified release dosage forms. There is several models to represent the drug dissolution profile where  $f_t$  is function of 't'(time) related to the amount of drug dissolved form the pharmaceutical dosage system. whenever a new solid dosage form is developed or produced, the drug release/dissolution from solid pharmaceutical dosage form is necessary to ensure that the drug dissolution occurs in an appropriate manner. Several theories/kinetics models describe drug dissolution form immediate and modified release dosage. These represent the drug dissolution profile where  $f_t$  is a function of 't'(time) related to the amount of drug dissolved from the pharmaceutical dosage form. The quantitative interpretation of the value obtained from the dissolution assay by mathematical equation which translates the dissolution curve in function of some parameters related with the pharmaceutical dosage form.

In the present study, data of the *in vitro* release were fitted to different equations and kinetic models to explain the release kinetics of Aceclofenac from the microspheres. The kinetic models used were a Zero order equation, first order, Higuchi model, Hixon crowell and peppas model.

## RESULT

### Infra-red spectrum

IR Spectrum of the drug sample was obtained using FTIR - 80400S, Shimadzu. 1.0 mg of the drug was mixed with 100mg of KBr in a mortar by trituration and the mixture was compressed in to a pellet at 10 ton /cm<sup>2</sup> in a pellet maker. The sample was scanned at 4000 cm<sup>-1</sup>- 400 cm<sup>-1</sup>. The IR Spectrum obtained was found concordant with the I.R Spectrum of Aceclofenac reported in the official monograph (Indian Pharmacopoeia 2007, Figure 4.1.6 & 4.1.7, Table 4.1.6)

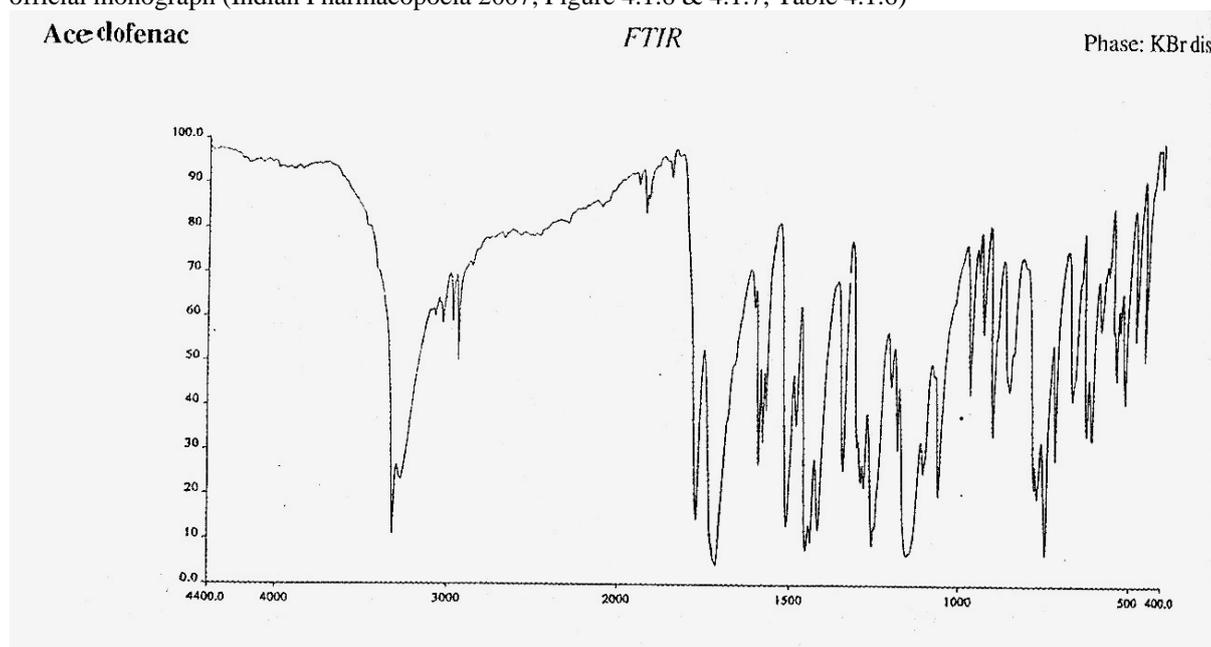


Figure 4.1.6.1: IR Spectrum of Aceclofenac (Standard)

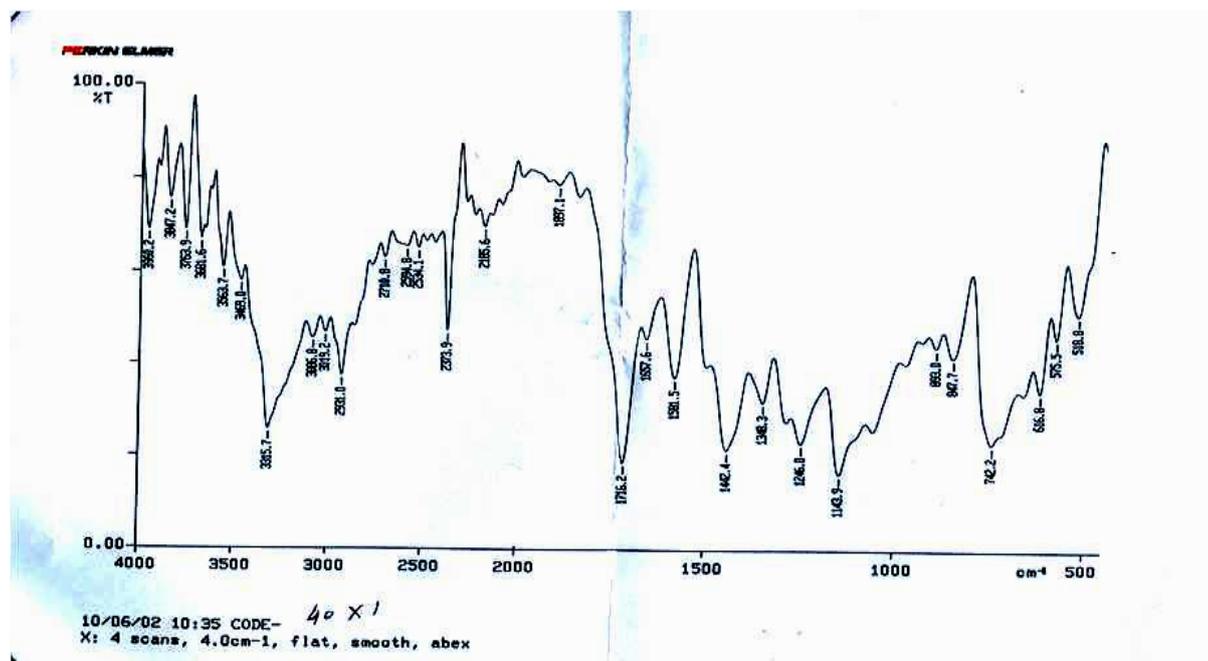


Figure 4.1.6.2:

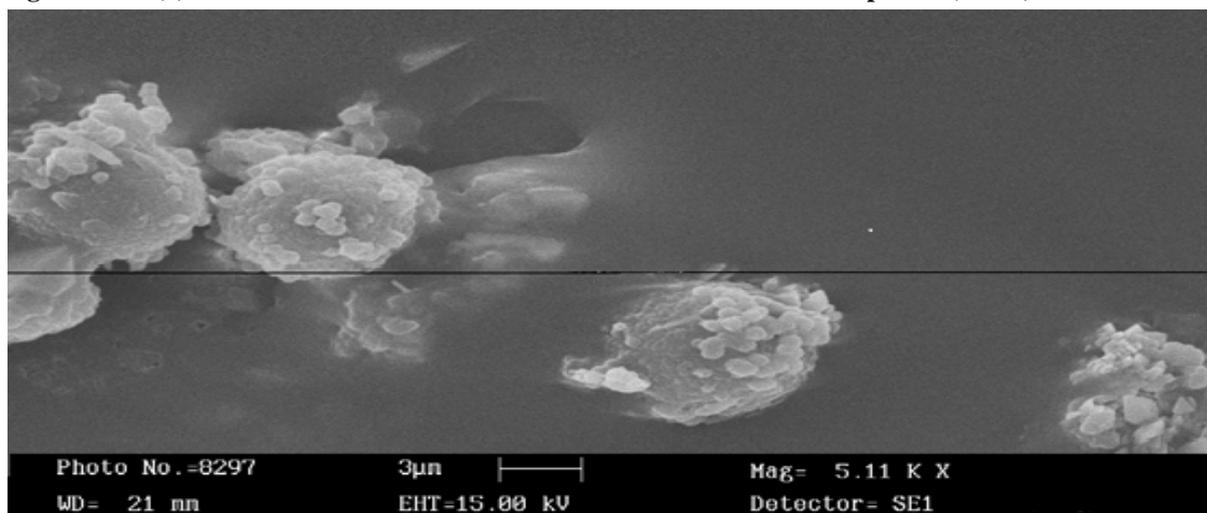
IR Spectrum of Aceclofenac (Test)  
 Table 4.1.6.: IR Spectrum peaks of the Aceclofenac

Groups	Standard peak (cm <sup>-1</sup> )	Observed Peak (cm <sup>-1</sup> )	Remarks
C- Cl	785-540	742.2	Stretching of halogen
=C-H-	3150-3050	2931.0	C-H stretching of CH <sub>2</sub> groups
-CH <sub>2</sub> -	1465	1442.4	-CH <sub>2</sub> - bending
N-H	3500-3100	3086.8	Aromatic Stretching of N-H
N-H	1640-1550	1657.6, 1581.5	Bending N-H
=O	1725-1700	1716.2	Stretching of carboxylic acid
C-OH	3400-2400	2873.38	Stretching, carboxylic acid
C-O	1300-1000	1143.9	Anhydride

## 4.2 EVALUATION OF MICROSPHERES

### 4.2.1 Shape and surface morphology

Figure 4.2.1: (a) SEM of Aceclofenac loaded Bovine Serum Albumin microspheres (BM-6).



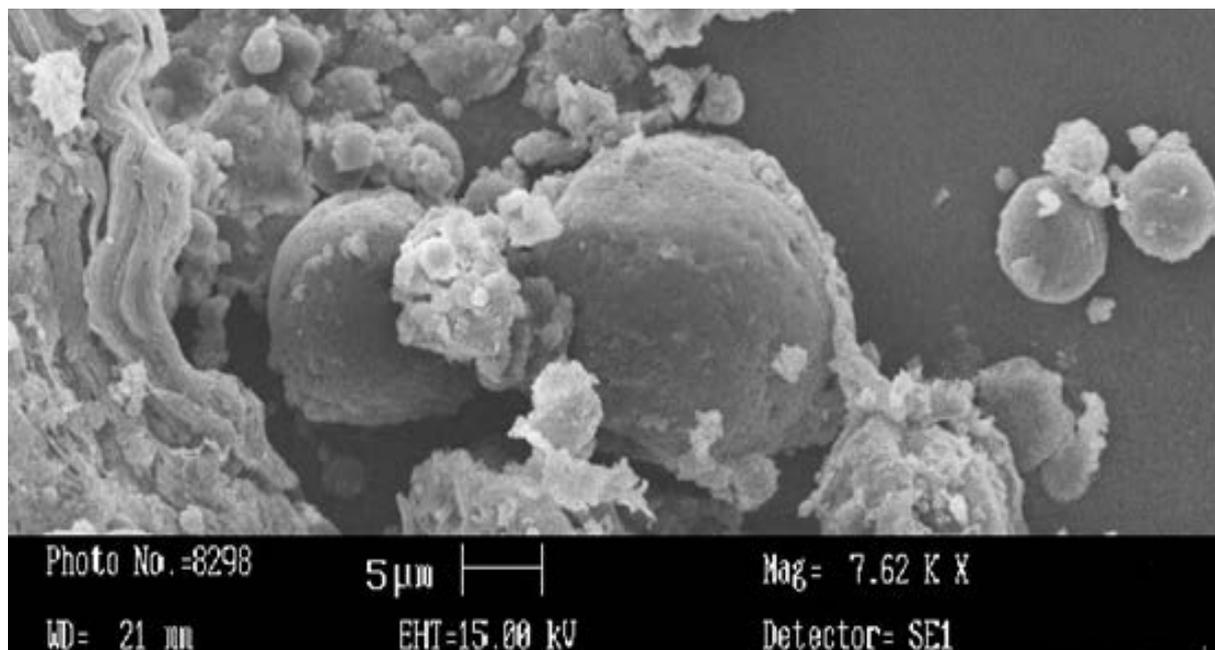


Figure 4.2.1: (b) SEM of aceclofenac loaded gelatin surface modified BSA microspheres (GBM-6).

4.2.2. Particle Size

Table 4.2.2.1: Experimental measured values for particle size of BSA microspheres (Taguchi orthogonal array table of L9).

Formulation	EXPERIMENTAL CONDITION				Average Particle size* (µm) (BSA)
	Factor A	Factor B	Factor C	Factor D	
BM-1	1	1	1	1	21.573±5.28
BM-2	1	2	2	2	19.918±3.91
BM-3	1	3	3	3	24.573±7.82
BM-4	2	1	2	3	19.466±4.78
BM-5	2	2	3	1	18.665±5.34
BM-6	2	3	1	2	20.817±3.21
BM-7	3	1	3	2	16.443±3.05
BM-8	3	2	1	3	18.573±4.57
BM-9	3	3	2	1	19.308±3.03

Values are Mean ±SD, n=10

Table 4.2.2.2: Experimental measured values for particle size of gelatin surface modified BSA microspheres (Taguchi orthogonal array table of L9).

Formulation	EXPERIMENTAL CONDITION				Average Particle size* (µm)
	Factor A	Factor B	Factor C	Factor D	
GBM-1	1	1	1	1	24.512±4.28
GBM-2	1	2	2	2	21.821±2.91
GBM-3	1	3	3	3	26.321±3.82
GBM-4	2	1	2	3	22.924±5.78
GBM-5	2	2	3	1	20.935±6.21
GBM-6	2	3	1	2	22.523±5.45
GBM-7	3	1	3	2	19.732±4.23
GBM-8	3	2	1	3	20.454±3.34
GBM-9	3	3	2	1	22.142±3.03

Values are Mean ±SD, n=10

4.2.3. Percent drug content and entrapment efficiency

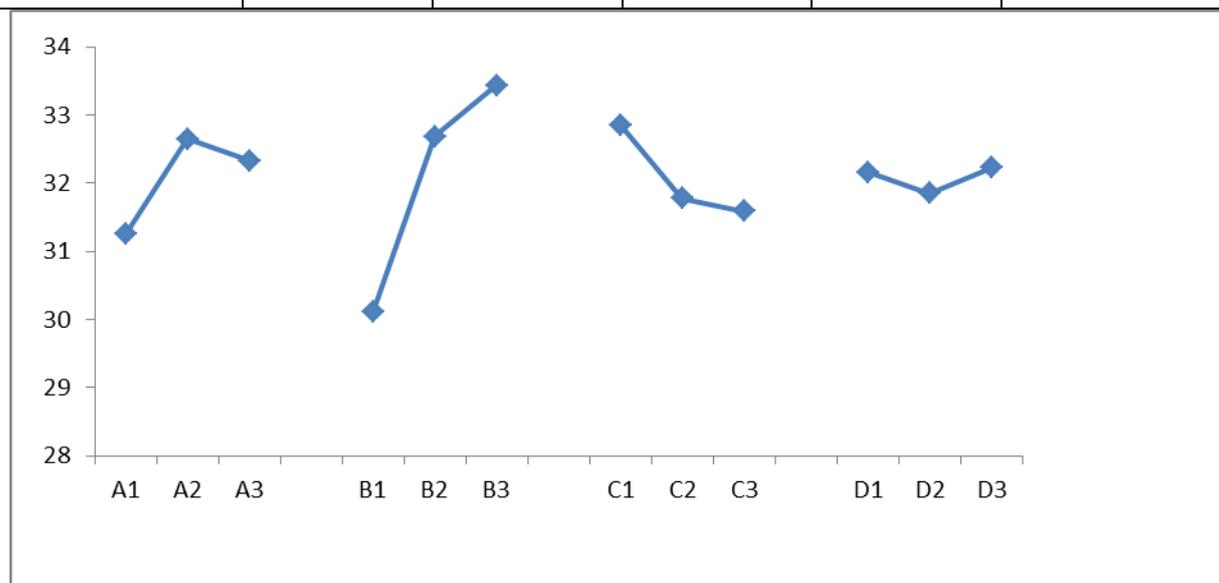
Table 4.2.3.1: Percent drug content and entrapment efficiency of various formulations of bovine serum albumin microspheres. (BM-1 to BM-9)

Formulations	Drug Loading (%)	Entrapment Efficiency (%)
--------------	------------------	---------------------------

BM-1	15.37	32.18
BM-2	21.84	36.87
BM-3	21.81	41.12
BM-4	12.95	33.65
BM-5	13.99	43.92
BM-6	23.51	53.3
BM-7	10.498	30.52
BM-8	21.91	49.29
BM-9	7.48	47.16

**Table 4.2.3.2: Experimental measured values for entrapment efficiency of BSA microspheres and S/N ratio (Taguchi orthogonal array table of L9).**

Formulations	EXPERIMENTAL CONDITION				Entrapment efficiency (%)	S/N ratio
	Factor A	Factor B	Factor C	Factor D		
BM-1	1	1	1	1	32.18	30.13
BM-2	1	2	2	2	36.87	31.33
BM-3	1	3	3	3	41.12	32.28
BM-4	2	1	2	3	33.65	30.54
BM-5	2	2	3	1	43.92	32.86
BM-6	2	3	1	2	53.3	34.56
BM-7	3	1	3	2	30.52	29.65
BM-8	3	2	1	3	49.29	33.87
BM-9	3	3	2	1	47.16	33.48



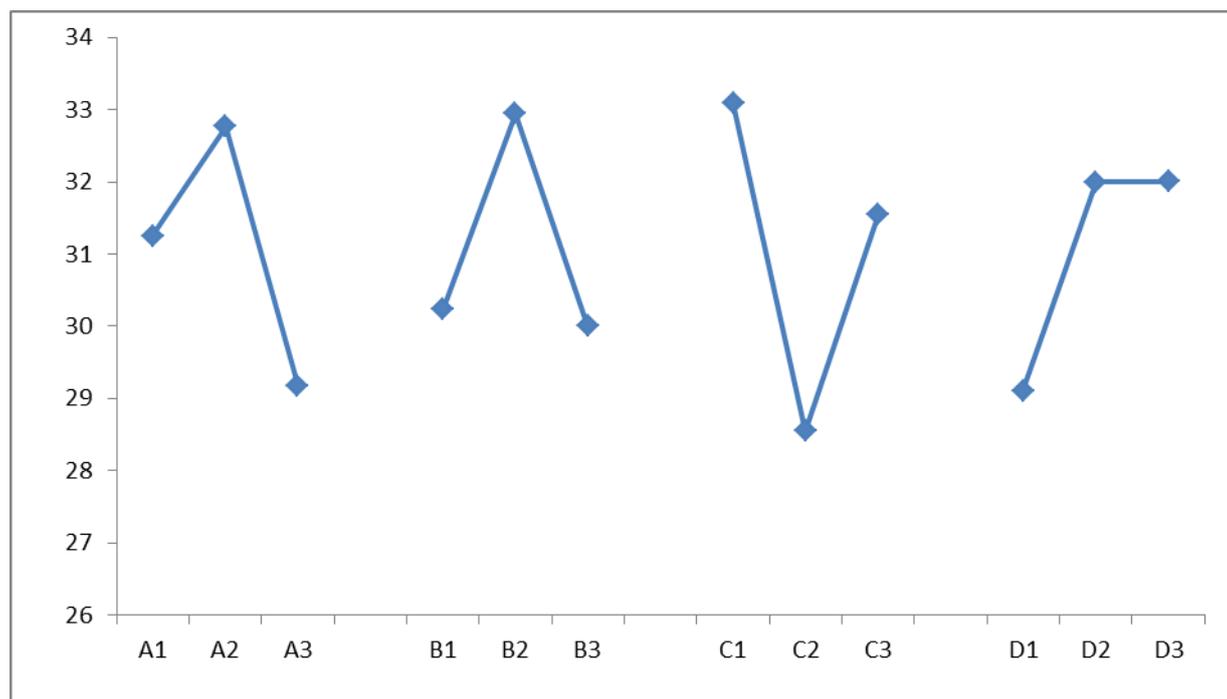
**Table 4.2.3.4: Percent drug content and entrapment efficiency of various formulations of gelatin surface modified bovine serum albumin microspheres. (GBM-1 to GBM-9)**

Formulations	Drug Loading (%)	Entrapment Efficiency (%)
GBM-1	16.24	33.83
GBM-2	23.21	37.86
GBM-3	24.34	41.86

GBM-4	14.72	33.07
GBM-5	14.86	46.12
GBM-6	24.23	54.18
GBM-7	11.17	30.86
GBM-8	22.83	50.37
GBM-9	8.87	48.12

**Table 4.2.3.5: Experimental measured values for entrapment efficiency of gelatin surface modified BSA microspheres and S/N ratio (Taguchi orthogonal array table of L9).**

Formulations	EXPERIMENTAL CONDITION				Entrapment efficiency (%)	S/N ratio
	Factor A	Factor B	Factor C	Factor D		
BM-1	1	1	1	1	33.83	30.58
BM-2	1	2	2	2	37.86	31.56
BM-3	1	3	3	3	41.86	31.62
BM-4	2	1	2	3	33.07	30.38
BM-5	2	2	3	1	46.12	33.27
BM-6	2	3	1	2	54.18	34.67
BM-7	3	1	3	2	30.86	29.78
BM-8	3	2	1	3	50.37	34.04
BM-9	3	3	2	1	48.12	33.48



**Determination of gelatin surface modification**

Determination of gelatin surface modification by Bradford protein assay procedure:-

**4.2.4.1 Preparation of dye stock solution**

100 mg of Coomassie Blue G was dissolved in 50 ml of methanol. To this solution 100 ml of phosphoric acid (85%w/v) was added and the resulting solution was diluted to 200 ml with water to give dark red colored solution. The solution is stable indefinitely in dark bottle at 4°C.

**4.2.4.2 Preparation of assay reagent**

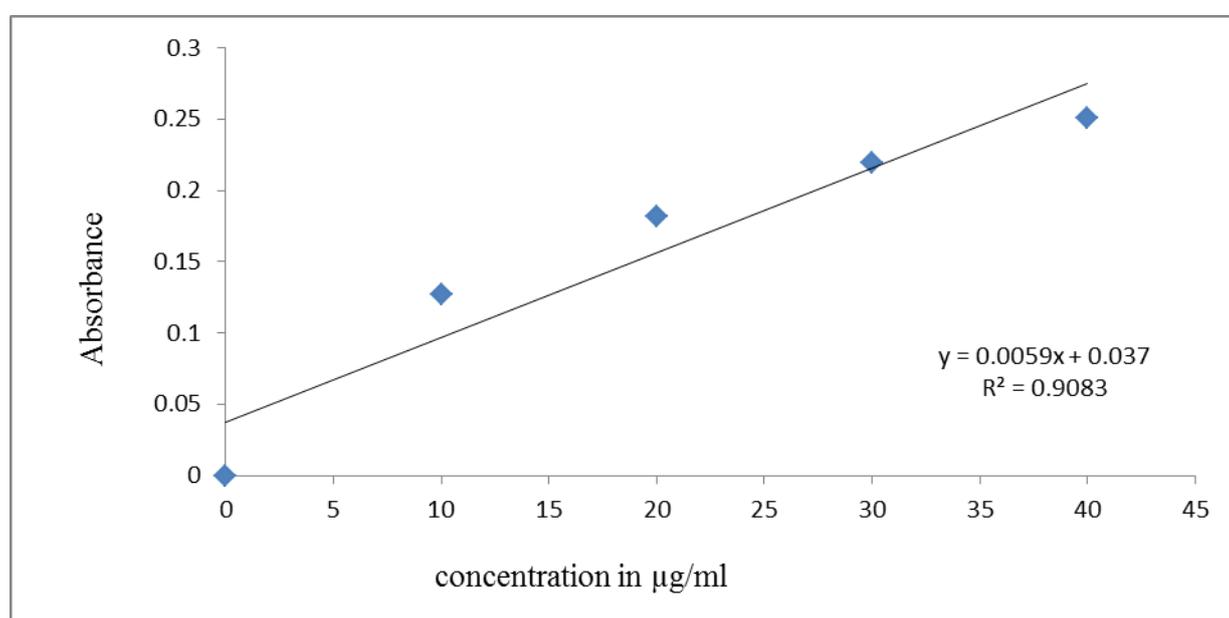
The assay reagent was prepared by diluting one volume of dye stock solution with four volumes of distill water. The solution is brown in color with a pH of 1.1. It is stable for weeks in dark bottle at 4°C.

**4.2.4.3 Preparation of Standard curve of gelatin**

Accurately weighed 100 mg of gelatin was dissolved in 100 ml of PBS pH (7.4) to give a solution of 1000 µg/ml concentration. This solution served as standard stock solution (I). From this solution 10 ml was taken and diluted to 100 ml using PBS pH (7.4) to get 100 µg/ml concentrations. 1 ml, 2 ml, 3 ml and 4 ml samples were taken and diluted up to 10 ml with PBS pH (7.4) to get concentration of 10, 20, 30, and 40µg/ml respectively. 2 ml of the assay reagent was added into each test tube and incubated at 37 °C for 1 hrs. The resultant color intensity was measured by colorimetry at the wavelength 590 nm.

**Table 4.2.4.3: Standard curve of gelatin using Bradford Dye Assay at 590nm**

S.N.	Concentration (µg/ml)	Absorbance
1	0	0.000
2	100	0.127
3	200	0.182
4	300	0.219
5	400	0.251



**Figure 4.2.4.3: Regression curve of gelatin in phosphate buffer saline pH 7.4**

**4.2.4.4 Protein Assay Procedure**

Accurately weighed 10 mg of gelatin adsorbed BSA microspheres of aceclofenac (GBM-6) were taken and mixed with 10 ml PBS pH (7.4). 2.0 ml assay reagent was added and the solution was shaken for 10 minutes. Gelatin content of the microspheres was determined by measuring the optical density (OD) of the solution at 590 nm (Bradford M, 1976).

Total protein bound to the microspheres was measured by Bradford dye assay method. The concentration of gelatin adsorbed on to the surface of BSA microspheres of the optimized batch (GBM-6) was found to be 19.425µg/ml.

#### 4.2.5 *In-vitro* drug release study

**Table 4.2.5.1: Percent cumulative drug release of aceclofenac from bovine serum albumin microspheres**

Time	BM-1*	BM- 2*	BM-3*	BM- 4*	BM-5*	BM-6*	BM-7*	BM-8*	BM-9*
15 min	18.41±0.28	21.15±0.24	11.42±0.32	8.97±1.05	20.26±0.81	22.54±0.49	16.01±0.54	14.09±0.65	23.65±0.82
30 min	23.71±0.50	26.57±0.41	17.53±0.42	12.23±0.76	25.70±0.42	28.12±0.64	22.66±0.39	19.08±0.82	28.91±0.36
1 hrs.	27.16±0.16	27.89±0.24	22.47±0.31	18.38±0.96	29.89±1.02	37.61±0.31	28.71±0.49	24.15±0.40	37.08±0.99
2 hrs.	36.45±0.51	36.13±0.40	28.05±0.39	24.40±0.32	34.86±0.40	44.14±0.67	31.03±0.57	28.40±0.43	43.43±0.58
3 hrs.	44.21±0.37	43.53±0.42	37.75±0.37	37.09±0.41	38.72±0.42	49.81±0.41	38.24±0.88	32.86±0.94	47.89±1.04
4 hrs.	58.55±0.25	57.26±0.19	47.24±0.40	46.53±0.57	45.11±1.05	54.77±0.35	46.77±0.33	37.16±0.48	54.85±0.22
6 hrs.	66.62±0.39	62.5±0.37	57.87±0.39	56.17±0.86	53.28±0.63	62.97±0.66	53.86±0.51	40.05±1.29	67.48±0.63
12 hrs.	75.17±0.22	72.7±0.42	64.96±0.24	63.61±0.38	74.27±0.57	68.54±0.42	71.84±0.67	67.64±1.19	76.68±0.99
24 hrs.	80.06±0.46	77.42±0.32	71.60±0.51	68.85±0.94	84.94±0.22	81.93±0.84	79.09±0.89	75.03±1.01	82.44±0.92

\*Values are Mean ±SD

**Table 4.2.5.2: Experimental measured values of %cumulative release after 24 hrs. of BSA microspheres and S/N ratio (Taguchi orthogonal array Table of L9)**

Formulations	EXPERIMENTAL CONDITION				Dissolution data after 24 hrs.	S/N ratio
	Factor A	factor B	Factor C	Factor D		
BM-1	1	1	1	1	80.06	38.13
BM-2	1	2	2	2	77.42	37.78
BM-3	1	3	3	3	71.60	37.10
BM-4	2	1	2	3	68.85	36.76
BM-5	2	2	3	1	84.94	38.58
BM-6	2	3	1	2	81.93	38.27
BM-7	3	1	3	2	79.09	37.96
BM-8	3	2	1	3	75.03	37.50
BM-9	3	3	2	1	82.44	38.32

**4.2.6 In-vitro drug release**

**Table 4.2.6: Percent cumulative drug release of aceclofenac from gelatin surface modified BSA microspheres**

<b>Time</b>	<b>GBM-1*</b>	<b>GBM- 2*</b>	<b>GBM-3*</b>	<b>GBM-4*</b>	<b>GBM-5*</b>	<b>GBM-6*</b>	<b>GBM-7*</b>	<b>GBM- 8*</b>	<b>GBM-9*</b>
<b>15 min</b>	15.51±0.69	19.58±0.71	12.54±0.71	7.80±0.84	18.65±0.57	20.82±1.09	14.61±0.92	9.88±0.61	22.46±0.60
<b>30 min</b>	20.69±0.35	23.06±0.79	17.68±0.36	10.67±0.69	24.53±0.73	26.59±0.78	20.85±0.60	15.53±0.90	27.42±0.50
<b>1 hrs.</b>	23.28±0.51	26.91±0.99	23.35±0.77	17.00±0.72	28.28±0.28	36.00±0.56	27.78±0.48	20.97±0.58	36.25±0.92
<b>2 hrs.</b>	33.52±0.84	34.59±0.67	27.33±0.49	22.90±0.49	33.09±0.75	43.89±0.73	29.77±0.64	27.42±.72	41.94±0.66
<b>3 hrs.</b>	40.20±0.69	42.05±0.55	31.56±0.94	35.50±0.75	37.28±0.42	48.29±0.24	36.55±0.92	36.23±0.85	45.93±1..02
<b>4 hrs.</b>	51.87±0.48	55.59±0.43	36.34±0.78	44.96±0.34	43.86±0.34	53.39±0.52	45.13±1.29	45.75±0.70	53.32±0.42
<b>6 hrs.</b>	59.36±1.01	61.18±0.85	48.90±0.36	54.72±0.51	51.92±0.82	61.46±0.96	51.70±0.45	56.34±0.45	65.61±0.81
<b>12 hrs.</b>	66.74±0.47	70.96±0.99	66.72±0.92	62.11±0.81	74.22±0.42	67.34±0.59	70.73±1.09	63.38±0.56	75.20±0.38
<b>24 hrs.</b>	72.10±0.73	76.01±0.43	72.17±0.67	67.44±0.45	83.85±1.10	80.32±0.86	77.78±0.88	71.09±1.21	81.08±0.73

\*Values are Mean ±SD

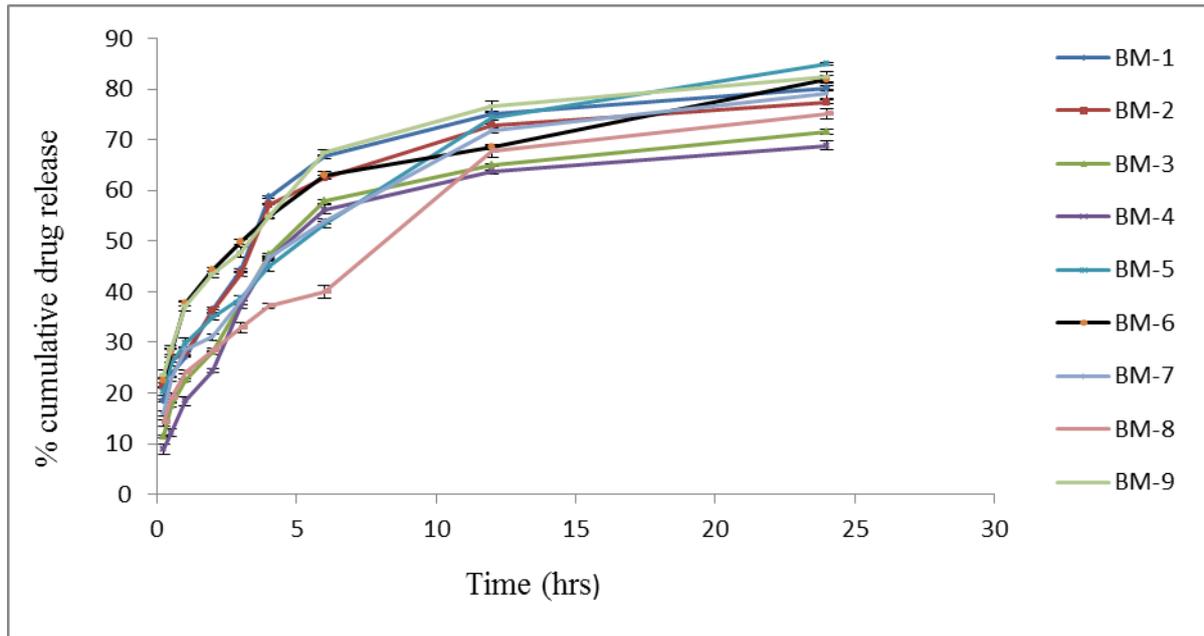


Figure 4.2.6.1: Percent cumulative drug release of Aceclofenac from bovine serum albumin microsphere in PBS (6.8)

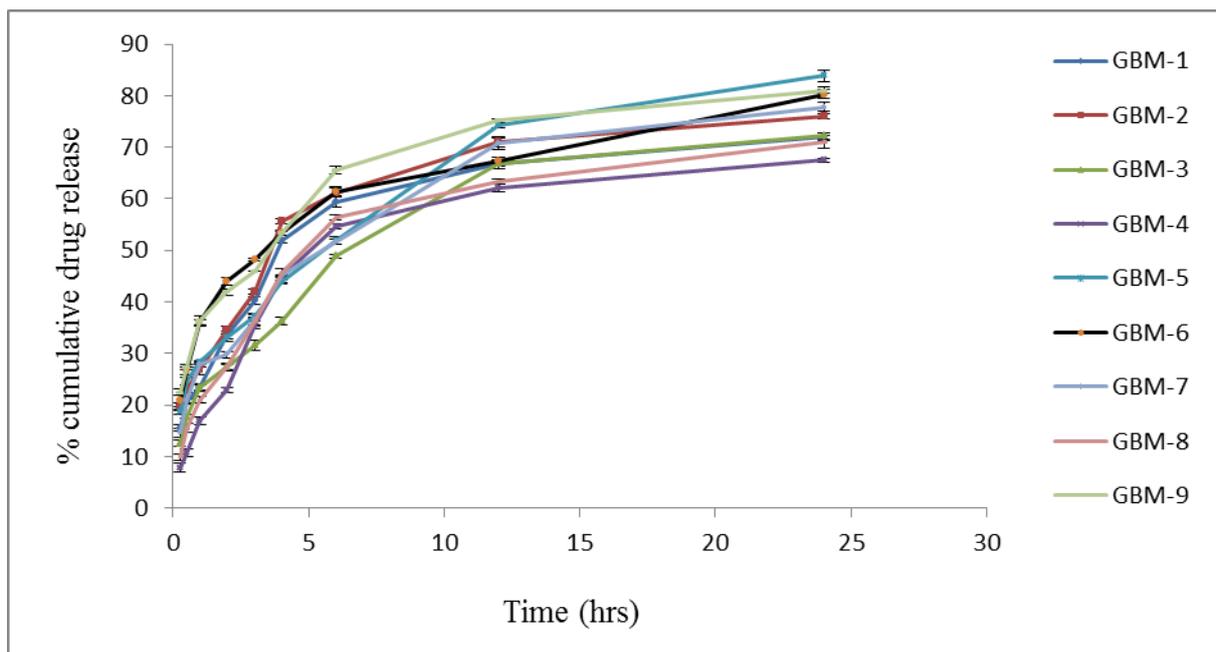


Figure 4.2.6.2: Percent cumulative drug release of aceclofenac from gelatin surface modified bovine serum albumin microsphere in PBS (6.8)

### 4.2.7 Drug Release Kinetics

To examine the drug release kinetics, the release data was fitted into models representing zero order, first order, and Higuchi's square root of time kinetics. The coefficient of determination ( $R^2$ ) values were calculated from the plots of  $Q$  vs  $t$  for zero order,  $\log(Q_0-Q)$  vs  $t$  for first order and  $Q$  vs  $\sqrt{t}$  for Higuchi model, and  $\log$  cumulative % drug release vs.  $\log$  time for korsmeyer model, where  $Q$  is the amount of drug released at time  $t$ ,  $(Q_0-Q)$  is the amount of drug remaining after time  $t$ .

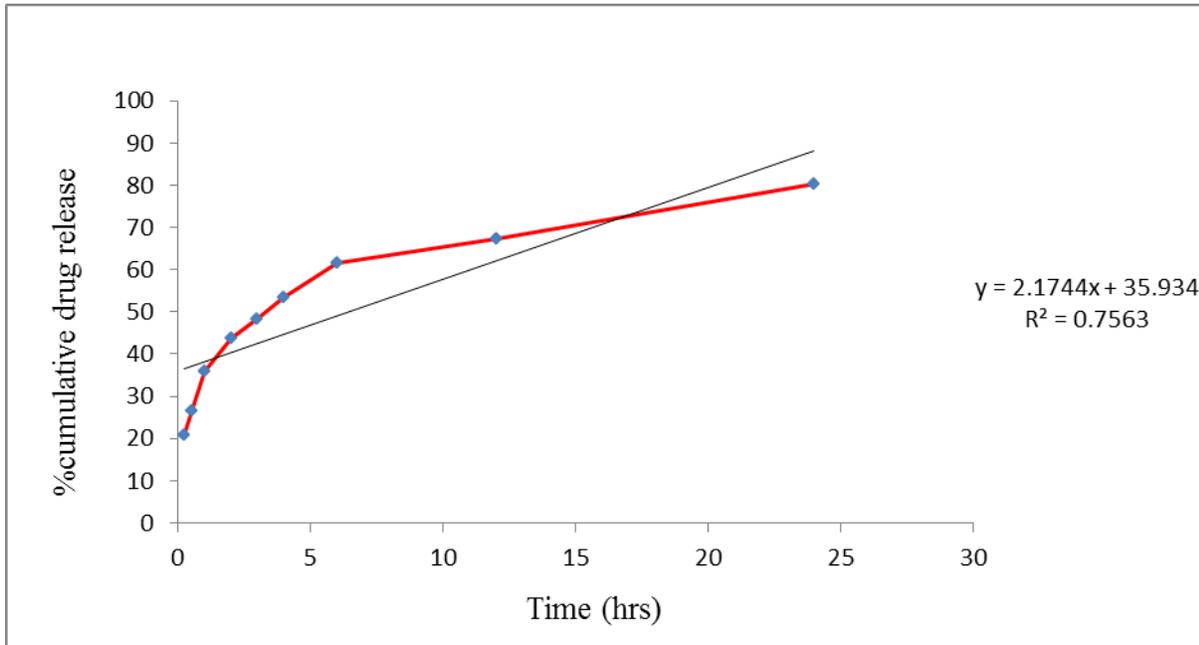


Figure 4.2.7.1: Zero order plot of GBM-6

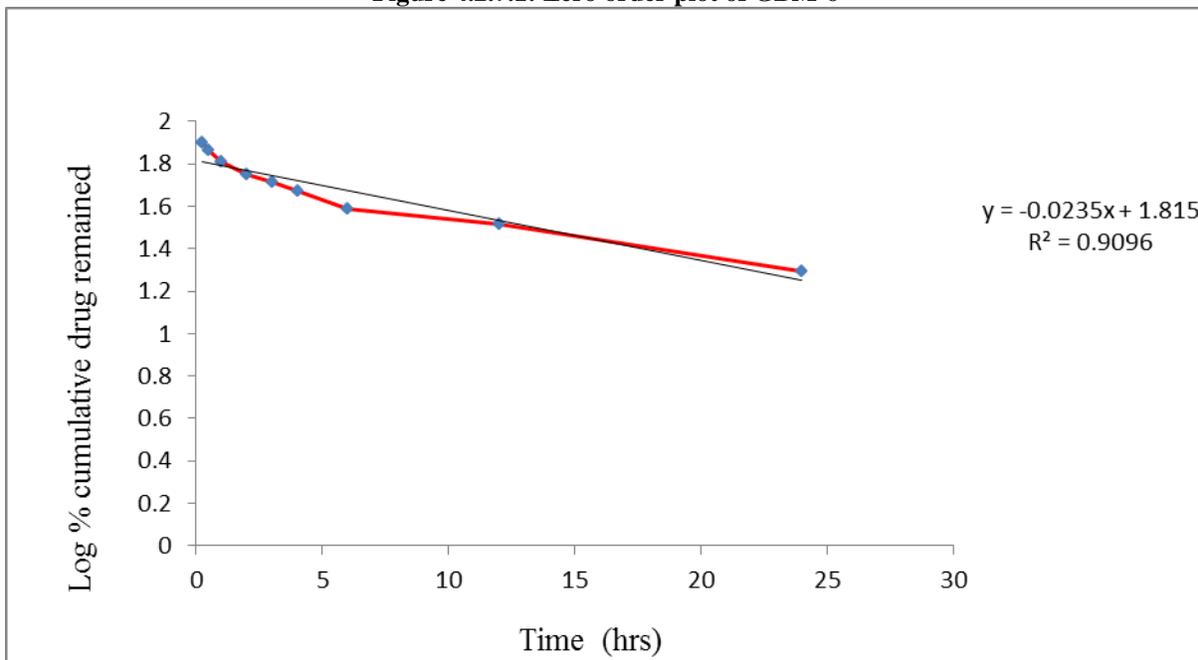


Figure 4.2.7.2: First order plot of GBM-6

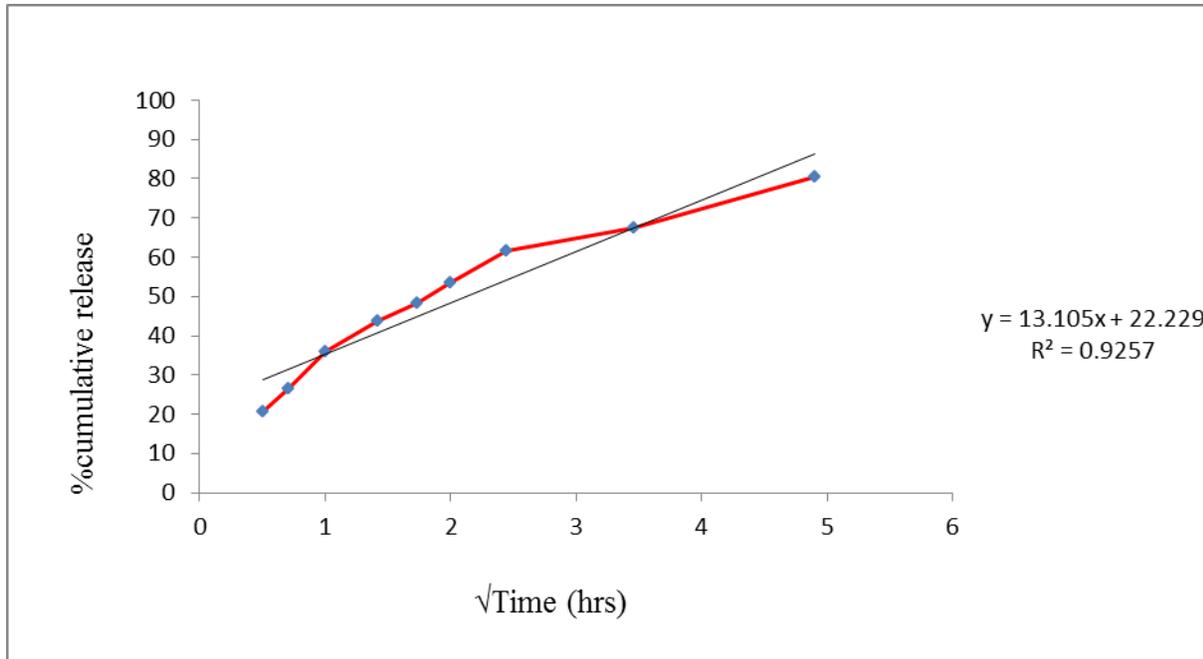


Figure 4.2.7.3: Higuchi Plot of GBM-6

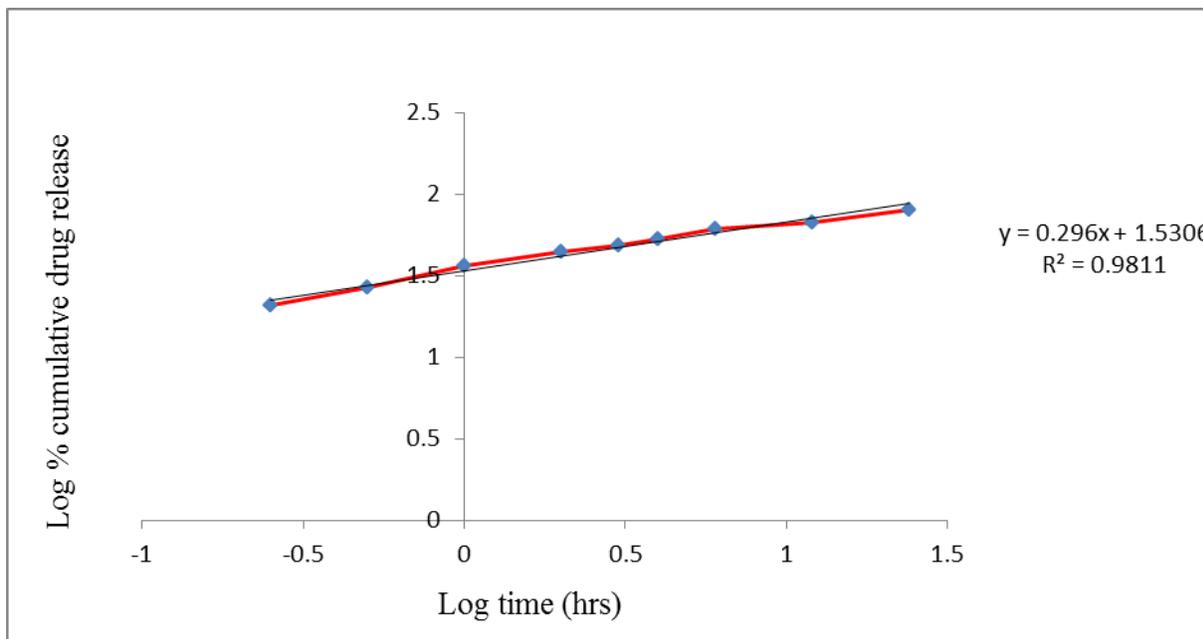


Figure 4.2.7.4: Korsmeyer's Peppas Plot of GBM-6

Formulations	Zero order	First order	Higuchi model	Korsmeyer model
	r <sup>2</sup>	r <sup>2</sup>	r <sup>2</sup>	r <sup>2</sup>
GBM-1	0.691	0.797	0.881	0.961

GBM-2	0.710	0.822	0.891	0.961
GBM-3	0.828	0.913	0.954	0.983
GBM-4	0.686	0.784	0.877	0.952
GBM-5	0.878	0.964	0.975	0.967
GBM-6	0.756	0.909	0.925	0.981
GBM-7	0.823	0.920	0.957	0.982
GBM-8	0.724	0.834	0.904	0.966
GBM-9	0.746	0.873	0.919	0.982

**Table 4.2.7: Release Kinetics of Aceclofenac from gelatin surface modified BSA microspheres**

**4.3 STABILITY STUDIES**

Ability of a formulation to retain its properties in specified limits throughout its shelf life is referred to as stability. Stability of a pharmaceutical product may be defined as capability of a particular formulation, in a specific container, to retain its physical, chemical, microbiological, therapeutic, and toxicological specification.

The objective of stability study is to determine the shelf life, namely the time period of storage at a specified condition within which the drug product still meets its established specifications.

The stability of finished pharmaceutical products depends on several factors. On one hand it depends on environmental factors such as ambient temperature, humidity, and light. On the other hand, it depends on the product related factors such as physical and chemical properties of active substance and pharmaceutical excipients, dosage form and its composition, manufacturing process, nature of container, closure system, and properties of packaging materials.

The chemical stability of drug is of great importance since it becomes less effective as it undergoes degradation. Also drug decomposition may yield toxic by products that are harmful to the patient. Microbiological instability of a sterile drug product could also be hazardous.

Stability of a formulated product on shelf becomes an important factor in successful development of any dosage form. A study of stability of a pharmaceutical product is essential for three main reasons; safety of the patient, legal requirements concerned with the identity, strength, purity and quality of product and to prevent the economic repercussion of marketing an unsuitable product.

A well designed stability testing plan is essential and pertinent part of the quality assurance program.

**4.3.1 Storage Condition**

Prepared formulation (GBM-6) was stored in screw capped glass bottle at refrigerated temperature (2-8<sup>0</sup>C) and room temperature (20-25<sup>0</sup>C). Samples were analyzed for residual drug content after a period of 7, 15, 30 45 and 60 days. Initial drug content was taken as 100% for each formulation.(Patil SS et al),(Amirijahed AK et al).

**Table 4.3.1: Effect of aging on residual drug content at refrigerated temperature**

Formulation	% Residual drug contents at refrigerated temperature (2-8 <sup>0</sup> C) Mean ± S.D., n = 3					
	0 Days	7 Days	15 Days	30 Days	45 Days	60 Days
GBM-6	99.88±0.23	99.35±0.39	98.80±0.22	98.57±0.19	98.07±0.32	97.59±0.35

**Table 4.3.2: Effect of aging on residual drug content at room temperature**

Formulation	% Residual drug contents at room temperature ( 20-25 <sup>0</sup> C) Mean ± S.D., n = 3					
	0 Days	7 Days	15 Days	30 Days	45 Days	60 Days
GBM-6	99.85±0.21	98.61±0.63	97.09±0.52	96.23±0.53	95.52±0.27	94.88±0.26

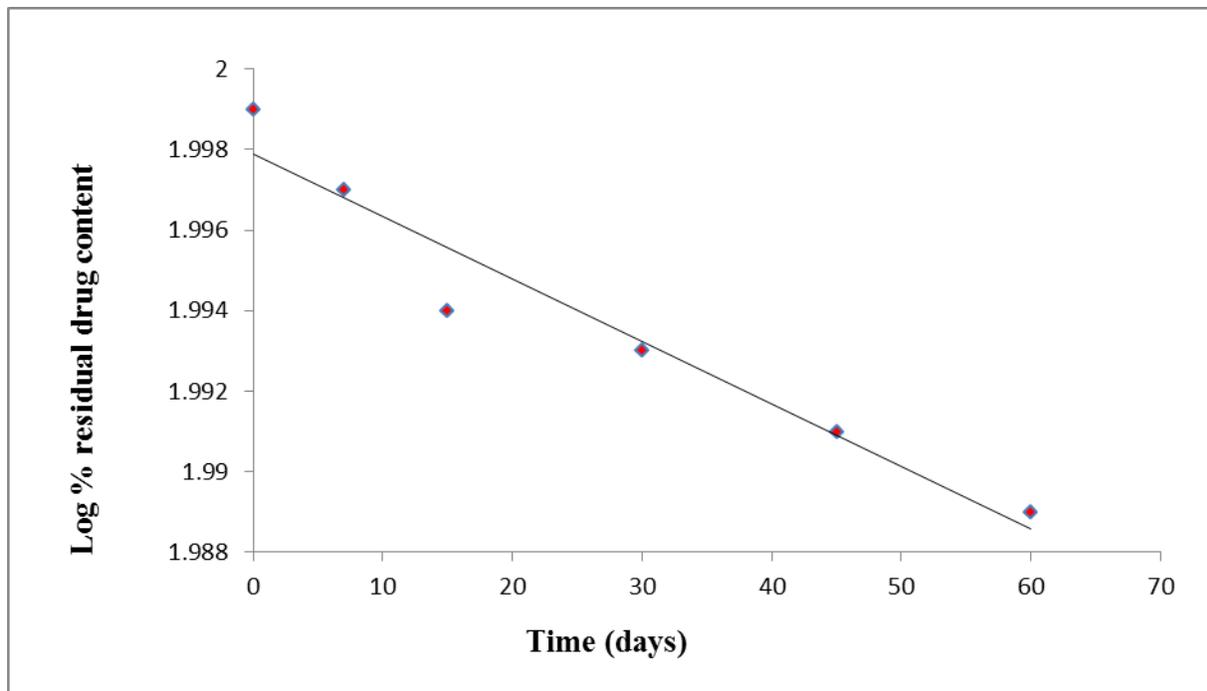
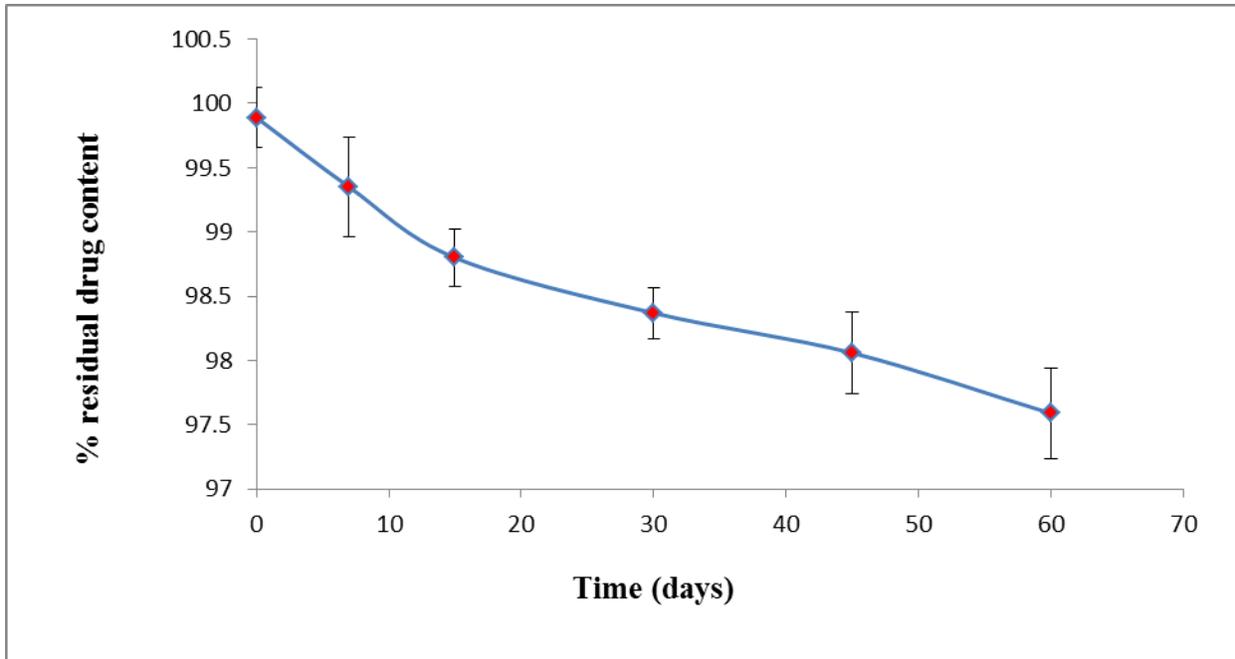


Figure 4.3.1: Residual drug content of GBM-6 at refrigerated temperature

Figure 4.3.2: Log % residual drug content of GBM-6 at refrigerated temperature

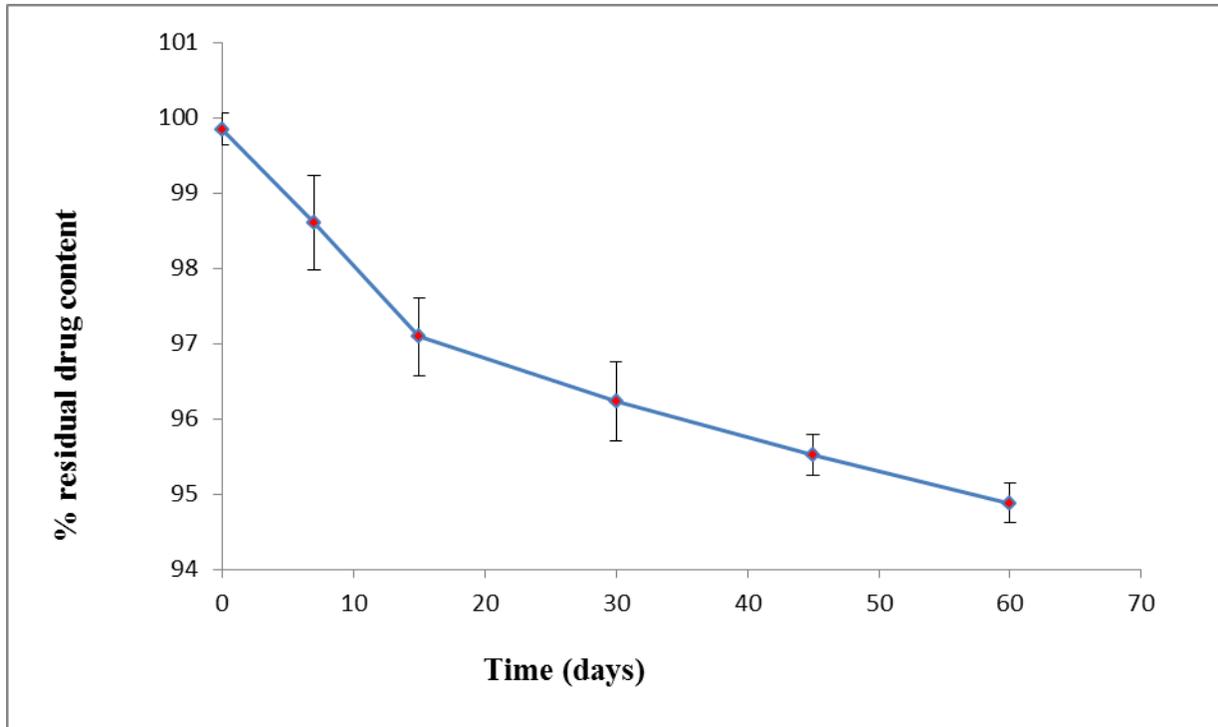


Figure 4.3.3: Residual drug content of GBM-6 at room temperature

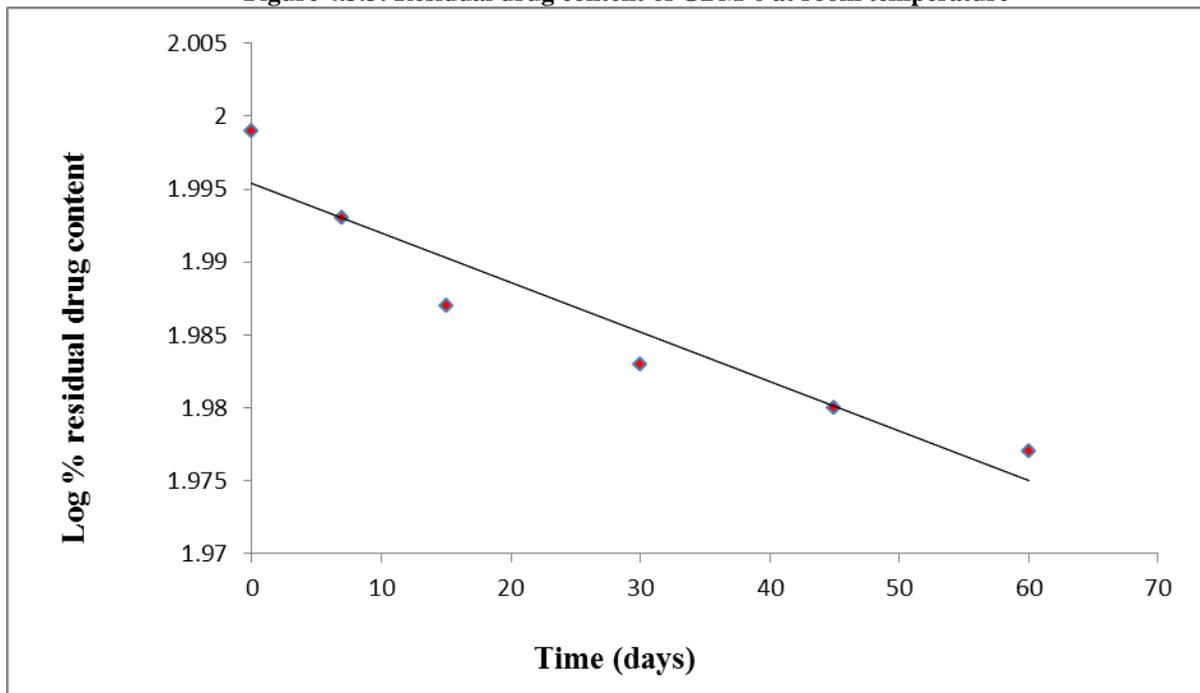


Figure 4.3.4: Log % residual drug content of GBM-6 at room temperature

#### 4.3.2 Results and Discussion of stability

The optimized formulation GBM-6 was stored at two different temperature conditions refrigerated temperature and room temperature. To obtain an optimal storage condition, percent residual drug content and log % residual drug content was calculated at different time interval (0, 7, 15, 30, 45, and 60 days) and graphs were plotted between percent residual drug content vs time, and log % residual drug content vs time. [Figure 4.3.1, 4.3.2, 4.3.3, 4.3.4].

Figure 4.3.2 and 4.3.4, reflect an almost linear relationship. Degradation rate constant 'k' was calculated from the log % residual drug content vs time plot. By putting the value of 'k' in equation (8) and (9) values of  $T_{10\%}$  and  $t_{1/2}$  were calculated.

**Table 4.3.3: Shelf life and half-life of optimized formulation (GBM-6)**

S.N.	Parameters	Storage condition	
		Refrigerated temperature (2-8 °C)	Room temperature (20-25 °C)
1.	K (days)	$3.29 \times 10^{-4}$	$9.87 \times 10^{-4}$
2.	$T_{10\%}$ (days)	316	105
3.	$t_{1/2}$ (days)	2079	691

**CONCLUSION**

Shape and surface morphology of prepared BSA/GBSA microspheres was evaluated by SEM. The study revealed that most of the microspheres were fairly spherical in shape.

The geometric mean diameter of the bovine serum albumin microspheres was found to be  $19.926 \pm 2.271 \mu\text{m}$ . Mean particle size of the gelatin surface modified BSA microspheres was found to be  $22.523 \pm 5.45 \mu\text{m}$ . The particle size was found to be mainly dependent on the albumin concentration, surfactant concentration, and stirring speed. An increase in the albumin concentration from 4:1 to 6:1 led to a significant increase in the particle size. An increase in the surfactant concentration led to decrease in the particle size. There was a decrease in the particle size with an increase in the stirring speed from 1500 rpm to 2500 rpm.

Drug entrapment efficiency was mainly dependent on the drug polymer ratio and concentration of surfactant. Entrapment efficiency varied from 30.52% to 53.3%. An increase in the concentration of albumin from 4:1 to 6:1 led to a significant increase in the entrapment efficiency. There was a significant decrease in the entrapment efficiency with an increase in the concentration of surfactant.

All the batches showed an initial burst release ranging from 8.97% (BM-4) to 23.65% (BM-6). Initial burst release was followed by sustained release varying from 71.60 % (BM-3) to 84.94 % (BM-5). Percent cumulative drug release for the optimized formulation GBM-6 was found to be  $80.32 \pm 0.86$  at the end of 24 hours. This could be accounted for sustained release of the drug from gelatin surface modified BSA microspheres. Percent cumulative drug release decreased with an increase in the concentration of glutaraldehyde. The decrease in the drug release with an increase in the concentration of the glutaraldehyde is because of the formation of dense polymer cross-links leading to an increase in the diffusional path length that the drug molecules have to traverse.

The formulated gelatin surface modified BSA microspheres showed good entrapment and encapsulation efficiency with spherical geometry. The *in vitro* release profile revealed the ability of microspheres to prolong the drug release for more than 24 hrs.

It is possible to prepare gelatin surface modified BSA microsphere by emulsification chemical cross linking method which may be a suitable tool for site specific delivery of aceclofenac to the arthritic joints.

**The development of a system whereby drugs could be administered in a single dose that maintains active levels of the drug for a prolonged period would be the ideal system. Such a targeted and sustained release system has been developed in this study in the form of gelatin surface modified BSA microsphere containing aceclofenac.**

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# Investigation on Wireless Charging

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**Abstract-** Wireless charging is a innovation of transmitting power through an air gap to loads with the end goal of energy recharging. The current advance in wireless charging procedures and improvement of business items have given a promising option approach to address the energy bottleneck of traditionally convenient battery-controlled gadgets. However the fuse of wireless charging into the existing wireless communication system additionally carry a progression of testing issues with in regards to execution, scheduling and power administration. In this article we introduce far reaching diagram of wireless charging procedures, the improvements in specialized measures and some system applications. Actually the system applications of these generally have a place with medical implantation and versatile chargers for any electrical and electronic loads. Furthermore, we examine open difficulties in executing wireless charging innovations.

**Index Terms-** Wireless charging, Wireless Power Transfer, Magnetic coupling, Resonance coupling, Radiative/RF radiation, Acoustic Power transfer, Ultrasonic Resonance.

## I. INTRODUCTION

Wireless charging is also called as wireless power transfer, is a technology that enables the source to transmit the electromagnetic energy to a electrical load through the air gap without interconnecting cords. This innovation is drawing in an extensive variety of utilizations from a low power tooth brush to high power vehicle in view of its comfort and better client encounter. Presently a-days, this innovation is quickly developing from speculations towards the standard component of a business item particularly if there should be an occurrence of keen contraptions. Many driving organizations like Samsung, Apple, Huawei, started to discharge new era mobiles which are having in-fabricated wireless charging ability. Presently a-days is quickly developing from speculations towards the standard component of a business item particularly if there should be an occurrence of keen contraptions. Many driving organizations like Samsung, Apple, Huawei, started to discharge new era telephones which are having in-fabricated remote charging ability. IMS look into [3] imagined that wireless charging items will be 4.5 billion market by 2016 and it crossed the farthest point they evaluated. Pike inquire about [4] evaluated that the cordless controlled items will be tripled by 2020 getting to be 20 billion market.

Comparing to the traditional charging techniques the wireless charging has the following benefits:

- Firstly, it enhances the user-friendliness as the hassle from connecting cables is expelled

- Secondly, diverse brands and distinctive models can be charged by the same charger.
- Thirdly, it enhances the flexibility, especially for the devices for which replacing their batteries or connecting cords.
- Fourthly, it produces better durability (i.e., water proof and dust proof) for contact free devices.
- Fifthly, the wireless charging can give the asked for control by the charging gadgets on request mold and in this manner more adaptable and effective.

Nevertheless, normally wireless charging incurs higher implementation cost contrasted with wired charging. First, a wireless charger should be introduced as a substitution of conventional charging cord. Second, a mobile requires implantation of a remote power receiver. In addition, as wireless chargers regularly create more heat than that of wired chargers, extra cost on making material might be brought about.

The development of wireless charging is mainly going in two directions they are:

1. Radiative wireless charging (RF or radio frequency based wireless charging).
2. Non-radiative wireless charging (coupling based wireless charging).
3. Acoustic wireless charging (ultrasonic resonance based wireless charging)

*Radiative wireless charging* receives EM waves, precisely RF waves or microwaves for the power exchange through the medium as radiation (given in Section 4.2). The energy exchanged relies on upon the electric field of the EM wave which is radiative. Because of the safety issues raised by RF exposure [5] these charging for the most part works in low power area. On the other hand, *non radiative wireless charging* in view of the coupling of the magnetic field of the two coils inside a separation of curls measurement for energy transmission (given in Section 4.1). As the magnetic field of the EM wave lessens rapidly than the electric field of the EM wave so in this innovation the power exchange distance is especially restricted. Due non radiative nature, this innovation has been generally utilized as a part of day by day charging exercises.

Aside from the above advances there is a new charging innovation that which was developed as of late. It is '**Acoustic Power Exchange**'. In this really ultrasonics are utilized for the exchange of energy. The guideline required in his innovation was ultrasonic resonance. This innovation has a decent degree going into the market as it can be a proficient and eco-friendly (given in Section 4.3).

In this article we expect to give an extensive view on developing wireless charging accusing frameworks along of their principal technologies and application in correspondence systems. This view covers different real wireless charging advances like inductive coupling, magnetic resonance coupling, RF/microwave radiation, Acoustic(ultrasonic resonance) . The article arrange is as per the following, Right off the bat we will clarify how the wireless charging appeared i.e., history of it and the essential required in cordless power exchange wonder. Besides, the sorts of wireless charging innovations that appeared till now and there separate block diagrams, system flows, functionality, applications, advantages, disadvantages.

## II. HISTORY

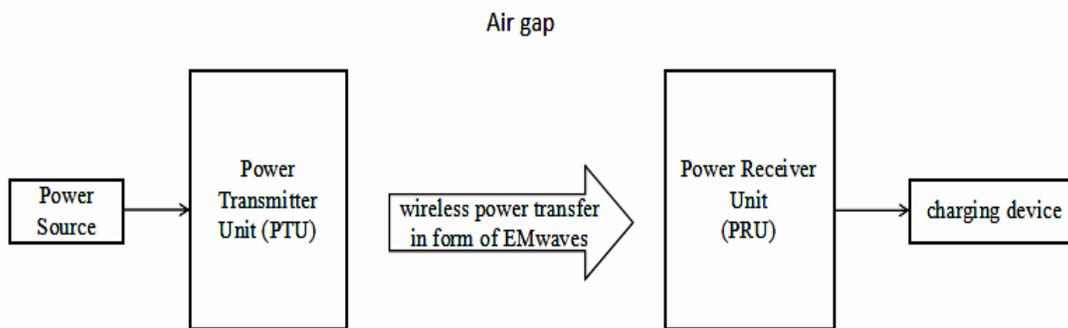
Electromagnetism is the pioneer point of remote power exchange where EM waves convey the energy. The investigation of electromagnetism was begun from 1819 when H.C. Oerster found the electric current creates magnetic field around it. Later on Ampere's Law, Biot-Savart's Law and Faraday Law had inferred to give some fundamental property of the magnetic field. Tailing them, in 1864 J.C. Maxwell acquainted a few conditions with describe how the electric and magnetic fields are produced and altered each other. Later in 1873 production of Maxwell book '*A Treatise on Electricity and Magnetism*' which actually unified the electricity and magnetism[15]. From that point forward the electricity and magnetism are said to be controlled by a same force.

Later on Nicolas Tesla, who is the founder of alternating current electricity, was the first to lead probe wireless power exchange by utilizing microwaves. He concentrated on long-distance wireless power transfer and understood the exchange of microwave signals over a separation around 48 kilometers in

1896. Another significant breakthrough was accomplished in 1899 to transmit  $10^8$  volts of high-frequency electric power over a separation of 25 miles to light 200 bulbs and run an electric motor[16,17]. However, the innovation that Tesla applied must be racked on the grounds that transmitting such high voltages in electric arcs would make appalling impact to people and electrical hardware in the vicinity. Around the same period, Tesla additionally made an extraordinary commitment to advance the attractive field progress by presenting the well known "Tesla coil", illustrated in 1901, Tesla developed the Wardenclyffe Tower, appeared into exchange electrical energy without cords/wires through the Ionosphere. In any case, because of innovation confinement (i.e., low system efficiency because of large scale electric field), the thought has not been generally additionally created and popularized. Beside Tesla, W.C. Brown, who is the practical engineer invented a component called Rectenna. This component is utilized to exchange the microwave power into electricity[20]. Advance improvements are taken in the rectenna configuration to get high power. This is the historical backdrop of wireless charging innovation.

## III. BASIC PRINCIPLE OF WIRELESS CHARGING

Wireless power transfer is process which is almost similar to the basic communication system process. Power is needed to be transferred from transmitter to the receiver by using different technologies or schemes (i.e., coupling method, RF method) which is as similar to that of the message signal transfer from the transmitter to the receiver in the basic communication system where we use different types of modulation schemes which are used to transfer the message signal effectively. In a simple way to say the wireless charging technologies are the analogous of modulation schemes in the communication systems



**Fig.1. Block diagram of basic wireless charging device**

Above figure 1 is the basic block diagram of the basic wireless charging technology. The primary square speaks to the power source which is for the most part known for all which gives the electrical power. The following square is the Power Transmitting Unit (PTU) which is the comprises of energy amplifier, matching circuits, A-D converters, correspondence module and resonator (primary) or transmitter. In this square the electrical energy changed over in type of EM waves where the EM waves convey the electrical energy to the following piece through the air gap. This PTU square has a similar functionality

of the modulator in the communication system. Alongside PTU, we have Power Receiving Unit (PRU) which comprises of resonator (secondary) or recipient, rectifiers, DC-DC converters, communication module. Here DC-DC converters rather than DC-AC converters as the load what we take for the most are batteries. The batteries store the energy in form of DC so despite the fact that we give DC input, the battery can take the energy and store it. This is one of the ideal element of favorable position of the wireless charging that is said in Sec-1.

IV. WIRELESS CHARGING TECHNOLOGIES

In this segment , we give the fundamental information of wireless charging which covers the standard of innovations,

existing use of that innovation. And additionally the charging system configuration in architecture, hardware equipment and implementation

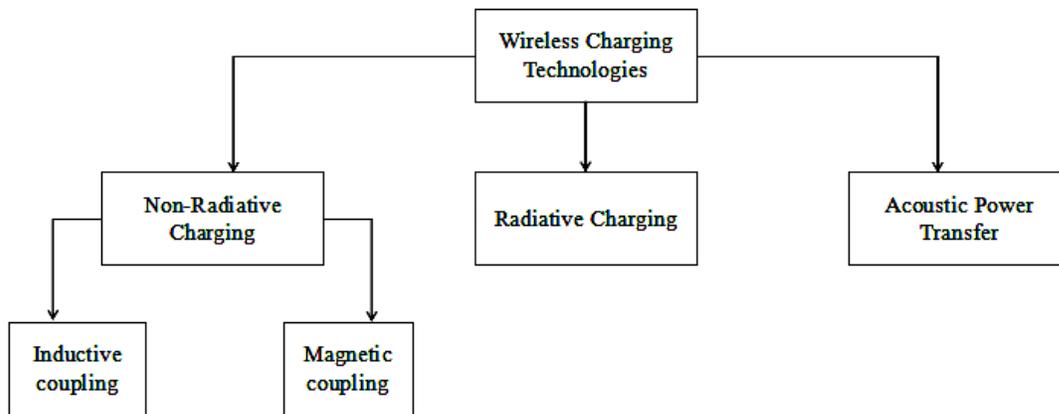


Fig.2. Classification of the Wireless Charging technologies

As illustrated in the above figure2 the wireless charging is extensively characterized into 3 types. They are non-radiative coupling based charging, radiative RF based charging and Acoustic ultrasonic based charging.

4.1 Non-Radiative Charging:

The block diagram of the general non-radiative charging is given in figure3 demonstrates a block diagram of a general non-

radiative wireless charging system. The transmitter side consists of i) an AC/DC rectifier, which converts alternating current (AC) to direct current (DC); ii) a DC/DC converter, which alters the voltage of a source of DC from one level to another; and iii) a DC/AC inverter, which changes DC to AC. The receiver side is composed of i) an AC/DC rectifier, which converts high-frequency AC into DC, ii) a DC/DC converter, which tunes the voltage of the DC, and iii) a load for charging applications.

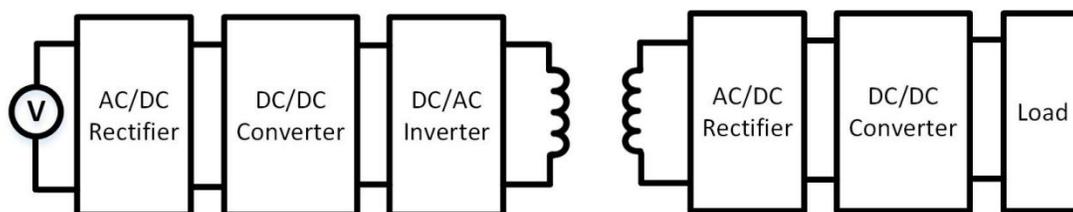
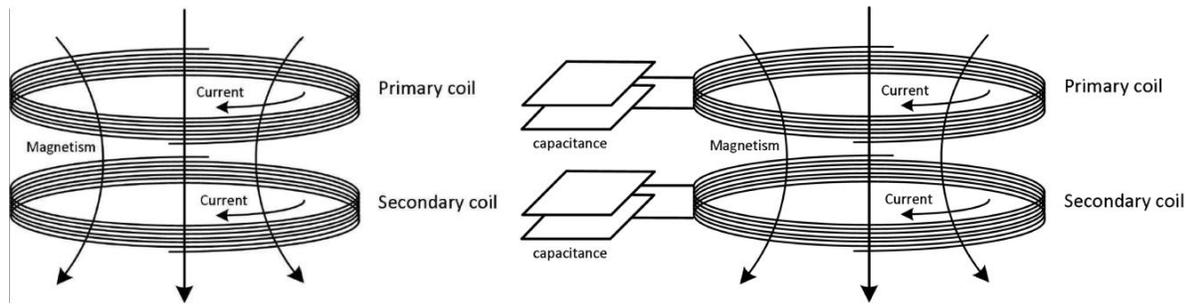


Fig.3. A block diagram of non radiative charging

The wireless charging process works as follows. First, a power source is required to actuate the AC/DC rectifier. As the commercial AC worldwide operates either in 50Hz or 60Hz frequency [9], which is too low to drive wireless charging, the charger increases the AC frequency by converting the AC to DC first, and then raising the voltage of DC and changing the DC back to high-frequency AC power. As the high-frequency AC that runs through the transmit loop coil creates a magnetic field around it, AC is induced at the receive loop coil separated away from the transmit coil by an air gap. The energy receiver then converts the induced AC to DC, and reshapes to the voltage required by the load. The battery of an electronic device can then be replenished at the load.

The above innovation is additionally ordered into three sorts in light of the coupling of the loops for the exchanging the

power. They are inductive coupling, magnetic coupling, capacitive coupling. In this capacitive coupling, the achievable amount of the coupling capacitance is based on the area occupied by the device. However for a typical size portable electronic device, it is difficult to create the required power thickness which forces a testing plan impediment. Due to this non-radiative charging is realized through two techniques i.e., magnetic inductive coupling, magnetic resonance coupling. These are for near field applications where the electromagnetic field dominates the region which is close to the transmitter and receiver. In case of far field applications the absorption of the radiation does not effect the receiver. By contrast, for near field applications the load was greatly influenced by the field produced by the transmitter[7]. This is because for far-field applications the transmitter and receiver are not coupled[8].



**Fig.4.a. Inductive coupling**

**fig.4.b. magnetic resonance coupling**

**4.1.1 Inductive coupling:**

In this technique the electrical energy is transferred between two coils based on the magnetic field induction. The model shown in the figure 4.a is the reference one. Inductive Power Transfer (IPT) occurs when the primary coil is excited by the source which overwhelmingly generates the varying magnetic field across the secondary coil of the energy receiver which is within the field, generally less than the wavelength of the field. The near field produces current/voltage across the secondary coil of the energy receiver within the field. This induced voltage can be used to charge wireless devices / storage systems. The frequency of operation of this technique is up to kilo Hertz. The secondary coil should be tuned at operating frequency keeping in mind the end goal to improve the charging efficiency [9]. Actually, the quality variables for this circuit are outlined with low esteem in light of the fact that exchanged power weakens rapidly for substantial quality values. Due to the lack of compensation of high quality values the effective charging distance is lessened in terms of centimeters [10].

**Features:** The advantages of the inductive coupling incorporate simplicity of execution, convenient operation, high efficiency (seen in close distance applications where distance is less than radius of the coil) and ensured safety. Along these lines, it is appropriate and prevalent for gadgets. This innovation is currently utilized as a part of continuous and it was first presented in the mobile business by Samsung. It is only applicable for only near field applications when it comes to far field this is inefficient this is the only drawback of this technology.

**4.1.2 Magnetic Resonance coupling:**

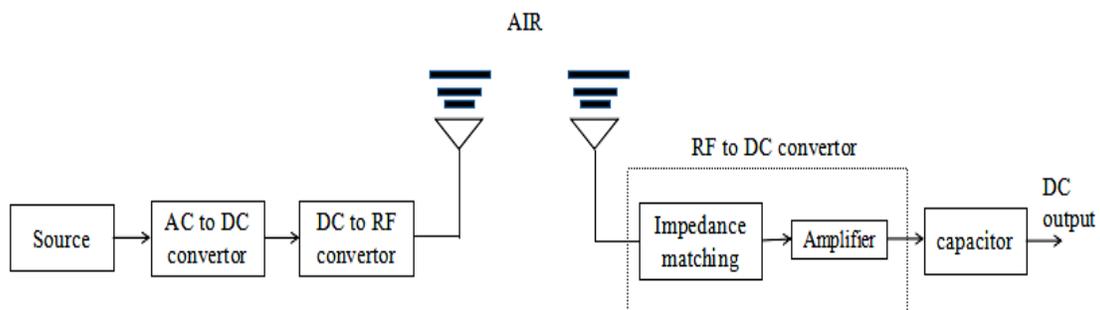
In this technique the coupling based evanescent wave coupling which generates and transfers the electrical energy between the resonant coils through fluctuating or swaying

magnetic fields. As the two resonant coils are operating in same resonant frequency, they are emphatically coupled, high energy transfer efficiency with small leakage to non-resonant externalities. Due to the property of resonance, magnetic resonance coupling is in favorable position of invulnerability to the area and observable pathway exchange prerequisite. Magnetically coupled resonators shown the capability in terms of power transmitting for long distances than the inductive coupling with higher productivity than that of RF radiation approach. Moreover, the one transmitter resonator can be coupled to numerous receiver resonator. In this manner it empowers simultaneous charging of various gadgets [21].

**Features:** As the magnetic resonance coupling typically operates in megahertz frequency range, the quality factor of the resonators are high. With the increase of effective charging distance there will be a sharp decrease of coupling efficiency of the resonator and thus results in the decrease charging efficiency. As the magnetic resonance coupling can charge multiple devices concurrently, by tuning the coupled resonators of multiple receiving coils. However mutual coupling occurs between the receiving coils can result in interference, so appropriate tuning of the resonator is required.

**4.2 Radiative Charging:**

In this technology the RF radiation utilizes diffused RF/microwave as the medium to carry the radiant energy. RF waves propagate through the space with the speed of light normally in line of sight. The typical frequency of the microwaves are 300MHz to 300GHz. We can also use infrared or X-ray electromagnetic waves for carrying the energy but these radiations are very harmful when contrast to the microwaves so they.



### Fig.5. A basic block diagram of radiative charging

Figure 5 demonstrates the architecture of a microwave power transmission system. The power transmission begins with the AC-to-DC conversion, tailed by a DC-to-RF conversion through magnetron at the transmitter side. After propagating through the air, the RF/microwave caught by the beneficiary rectenna are redressed into power once more, through a RF-to-DC change.

The RF-to-DC transformation productivity is profoundly reliant on the caught power at receiving antenna, the precision of the impedance matching between the antenna and the voltage multiplier, and the power effectiveness of the voltage multiplier that changes over the got RF signals to DC voltage [13]

**Features:** The RF energy can be radiated isotropically or towards some direction through beamforming. This former is mostly used on point-to-point communication and broadcasting areas. *Beamforming* can transmit electromagnetic waves, referred to as the energy of beamforming[14] which can expand the power transmission productivity. A beam is formed by antenna component. The sharpness of the energy of the beamforming enhances with the number of transmitting antennas. The use of massive antenna arrays can increase the sharpness of the energy. The recent development has occurred to construct massive antenna arrays like powercaster transmitter and Powerharvester receiver etc.

Besides long transmission distances microwave radiation offers the advantage of compatibility with the existing communication system. "Microwaves has a capability to transfer both energy and the information in the mean time", where the amplitude and phase of the microwaves gives the information, while its radiation and vibrations are utilised to carry the energy of the microwaves. The process of getting power and information is called as *Simultaneously Wireless Information and Power Transfer* (SWIPT)[14]. To oblige SWIPT we need to have advanced smart antenna technologies which is employed in the receiver have been developed to accomplish a favorable trade-off between system performance and complexity. By contrast, the deployment of dedicated power beacons overlaid with the existing communication system. However because of the wellbeing worries of RF radiations the power beacons should be constrained to some following RF exposure regulations[15]. Therefore dense deployment of power beacons is required to

power hand-held cellular mobiles with low power and shorter distance.

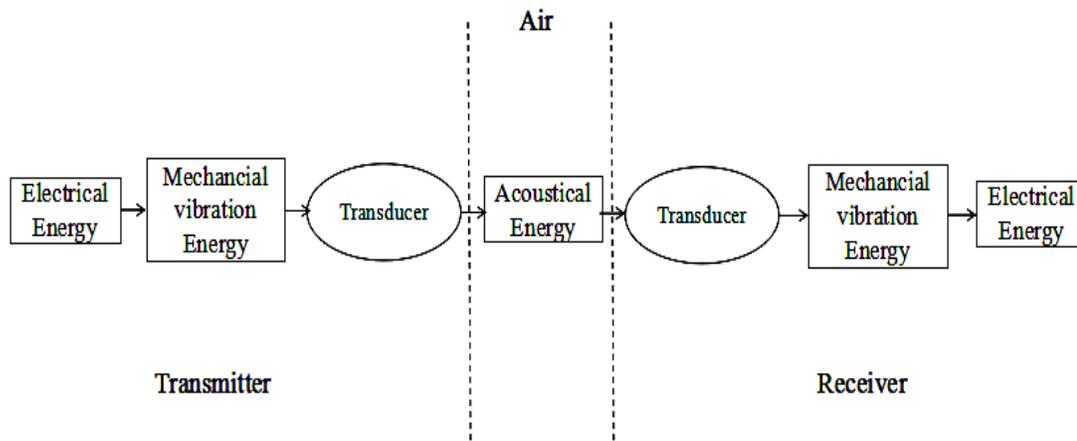
#### 4.3 Acoustic Power Transfer:

In this technology, ultrasonics which are sound waves used to transmit the power through the dielectric air media. This technology is a newly evolved one to have biocompatible wireless power transfer technique in bio-medical implantation i.e., implantable medical devices. The main principle involved is "Ultrasonic resonance"[17]. The engendering of ultrasonic waves is considerably lower than that of electromagnetic waves which are used in induction coupling or radiative technology. The ultrasonic wireless power transmission device can be easily designed and intended to have a short wavelength with moderately low operation frequency. As a result using ultrasonic waves, long distance power transmission is possible whereas the device maintains relatively small device size compared to electromagnetic wave devices.

The ultrasonic waves are generated using Magnetostriction or Piezoelectric method. The ultrasonic waves are used not for power transfer but also for data transmission. The power transmission using ultrasonics is as follows

- First, electrical energy used to produce ultrasonic waves from a piezo-electric component or transducer.
- The ultrasonic waves are transmitted through the media. It can have capability to travel 10-50m indoor (for implantable devices) and 100-200m outdoor.
- The transmitted ultrasonics are received by the receiver where the piezo component is used to convert the ultrasonic waves into electrical energy.

The entire procedure is *Piezo-electric effect and transverse Piezo-electric effect*. As we do not have transmitting and receiving antenna pair in the power transfer process we actually have Transmitting transducers and Receiving transducer instead of pair. In this technology the power is transmitted from transmitter to receiver in different form of energies[18]. The flow of power into various forms of energy is appeared in the figure 6



**Fig.6. Flow of Energy Conversion during acoustic power transfer**

The transmitter have a component necessities consideration to outline in light those transmission from claiming control relies in the matching effectiveness of the transmitting transducer for those getting transducer, Concerning illustration it produces the ultrasonics for obliged frequency that which camwood venture out through the networking What's more achieve those recipient. Secondary transmitting effectiveness might be acquired by bringing the transducers of same layer kind filling which might drive for helter skelter matching effectiveness of the transducers. The transmitter plan may be comparable to that of the rectifier circuit, the place the electrical energy may be provided for the out it provides for mechanical vibration energy which in-turn nourished of the transducer with get those yield, Similarly as acoustic energy(i.e., ultrasonic wave). The receiver plan will be simpler over that of transmitter which comprises of a accepting transducer and Power Administration System(PMS). The

accepted acoustic energy of the transducer specifically changes over of the electrical energy. This energy is nourished should PMS will control of the supply of the force of the load.

**Features:** The advantages of this technology are: the device(i.e.,power transfer setup) size is less when compared to other technologies. It is free from electromagnetic interference and absorption. It is possible to transmit the power not only in air but also in conductor and underwater where electromagnetic wireless transmission is difficult[19].

The table in the provides for the correlation of the wireless charging innovations. It likewise provides for the points of interest ,also hindrances from claiming each innovation alongside those compelling charging separation. By perceiving those over table, acoustic force exchange will be best for constant provisions. Other charging systems would effective be that not powerful in real time

**TABLE  
 Comparison of different Wireless Charging Techniques**

Wireless Charging Technique	Advantage	Disadvantage	Effective Charging Distance
Inductive coupling	safe for humans , simple implementation	short charging distance, heating effect, not effective for mobile applications, needs tight alingment between chagrers and charging devices	From few millimeters to few centimeters
Magnetic resonance coupling	Loose alingment between charger and charging devices, charging multiple loads at different power rate, high charging effeciency, non-line sight of charging	Not suitable for mobile applications, limited charging distance, complex implementation	From few centimetres to few meters
RF radiation	Long effective charging distance, suitable for mobile applications	not safe when RF exposure density is high, low charging efficiency, line-of-sight charging	Typically, from few meters to several kilometers
Acoustic Power Transfer	Long effective charging distance , suitable for mobile and medical applications	low charging efficiency	From tens of meters to hundreds of meters

## V. ENERGY CONVERSION EFFICIENCY

Wireless charging requires electrical energy to be transformed from AC to electromagnetic waves and then to Direct Current. Each conversion adds the loss in the overall energy, which normally leads to normal wireless charging efficiency hovering around 50% to 70%. This phenomenon is dominant in Radiative and acoustic power transfer technologies where for radiative charging the efficiency is around 70-75% and where it comes to acoustic power transfer the efficiency is around 55-65%, this because the electrical energy need to go for extra stage i.e., convert to mechanical vibration energy so the charging efficiency dropped by 10%. Efforts towards hardware improvement of energy conversion are instrumental to achieve high efficient wireless charging.

## VI. CONCLUSION

Wireless power technology offers the possibility of removing the last remaining cord connections required to replenish the compact electronic devices. This promising technology has significantly progressed during the past decades and established numerous user-friendly applications. In this article, we have presented a paradigm survey on the wireless charging technologies. Initiating from the development history, we have further introduced the fundamentals, main principle, international standards of wireless charging followed by their charging conversion efficiency rates.

The incorporation of wireless charging with the existing communication system creates new opportunities as well as resource allocation. This wireless charging has practical applications in the various communication networks like near-field beamforming schemes, distributed wireless charger deployment strategies, multiple access control for wireless power communication which should be additionally examined.

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# Effect of Performance Finish on Woven Fabric Properties

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**Abstract-** This study investigates influences of oil and water repellency finish, non-iron with soft finish, non-iron with oil and water repellency finish (OWR) on woven fabric with respect to physical properties, mechanical properties, color fastness properties of fabrics. Each process was applied on fabric to see how these applications affect on fabric characteristics. All the fabrics were tested for GSM, pH, stretch and recovery, dimensional stability to wash, tear strength, tensile strength, skewness. Fabric with oil and water repellency finish was also gone through spray rating test. Same fabric shows different characteristics after different performance finish and the results will be presented further ahead with comparing tables and charts.

**Index Terms-** OWR finish, non-iron finish, fabric strength, stretch, recovery, dimensional stability.

## I. INTRODUCTION

Oil and water repellency finish is defined as the ability of a textile material to resist oil and water. The spreading out of water and oil over a fiber or fabric surface is dependent on the angle of contact made by water and oil drop and the surface. The desire of the oil and water repellent finish is to make the fabric impermeable to oil and water so that the drop will rest up on the surface and will not penetrate into the fiber or fabric. [1]

Non-iron finish is done by resin treatment. Despite of some disadvantages such as changing shades, reducing whiteness, and containing formaldehyde content, resin finishing till now maintain its position in the finishing of textiles based on cellulosic fibers.[2] Resin finishing is done with products known as cross linking agents. These change woven and knitted fabrics composed of cellulosic fibers and their blends with synthetic fibers in such a way that the resulting textiles are easier to care for.

Considering the composition and properties of the fabric, soft finish is carried out when the softness characteristics of a fabric must be increased. The fabrics become harsh and stiff generally after dyeing and printing. Finishing and softeners altogether can solve this problem and improve on the original softness. The softening treatments greatly impart soft handle (supple, pliant, sleek and fluffy), smoothness, enhance flexibility, drape and pliability in fabric.

These three finishes have shown different effect on the test fabric. They change some characteristics of the fabric and it becomes difficult to meet the customer requirement and criteria. This study will point out the differences of the fabrics treated by OWR, non-iron and soft finish.

## II. MATERIAL AND METHOD

### A. Material Preparation

Fabric produced from 97% cotton, 3% spandex, having 3/1 S Twill and identical physical properties was selected for performance finish (Table 1). Before finishing fabric was dyed on black color using common recipe. Dyed fabric was treated using fixing agent- 5g/l, acetic acid- 2 g/l for excellent post setting stability, leveling effect and enhanced wet fastness ability. pH was kept 4 during the process and m/c speed was 35 m/min. Pad steam machine was used for this process. Temperature in steamer were 115°C, 1<sup>st</sup> chamber 30°C, 2<sup>nd</sup> to 7<sup>th</sup> chamber 70°C, and in dryer 140°C.

Table 1: Test fabric specification

Fabric Composition	97% Cotton , 3% Spandex
Weave	3/1 S Twill
Yarn Count	Warp Count: 20, Weft Count: 16+70D
Yarn Quality	Warp quality: 20/1 Auto Coro Yarn Weft Quality: 16+70D ( CW Lycra Core yarn)
Warp – Weft /Inch	142-78
Cover Factor	49.03 (SI Unit)
Weight gm/m <sup>2</sup>	305
Fabric	Solid dyed

### B. Methodology

Three type of finish: non-iron + OWR, oil and water repellent and non-iron + Soft Finish were done on same dyed fabric. Table 2 shows fabric code according to performance finish. As seen in table 2, selected chemical and mechanical finishes were applied separately or in combinations on fabric sample. Process condition of applied finishing process were summarized in table 3.

Table 2: Fabric Code according to applied finishing process

Fabric Code	Fabric Finish			
	Oil and water repellent finish	Non iron finish	Soft finish	Sanforising
0 ( Test specimen)	×	×	×	×
1 ( OWR+NI+SAN)	✓	✓	×	✓
2 (NI+SF+SAN)	×	✓	✓	✓
3 ( OWR+SAN)	✓	×	×	✓

Table 3: Details of the finishing processes

Finishing treatment	Parameter
Oil and water repellent finish	Oil and water repellent agent ( Phobol CP 2G- 150 g/l, Zelan R3 - 60 g/l, Extender XAN- 20 g/l ) , Wetting agent- 5 g/l, Softener- 3g/l , M/c name:Brückner,Germany, Temperature: 180 °C, M/c speed: 22 m/min, Pick up- 55%
Non Iron finish	Cross linking agent (Knittex RCT- 120 g/l, Turpex ACN- 50g/l), MgCl <sub>2</sub> - 20 g/l, Wetting agent- 5 g/l, M/c name: Brückner, Germany, Padder pressure: 2 bar, Temp- 140 °C, Pick up - 54%, M/c speed: 20 m/min
Soft finish	Softener for textile finishing( Ultratex SI + Ultratex FMI+ Turpex ACN - 90 g/l) Highly effective detergent - 1g/l, M/c speed: 25 m/min, M/c name: Brückner,Germany, Pick up-51 % , Temp-160°C, Padder pressure: 2 bar
Sanforising	Pressure : 1 bar,2% shrinkage control, M/c speed: 30 m/min

C. Performance tests

To determine physical properties fabric weight(gm/m<sup>2</sup>),pH, dimensional stability to wash, skewness, tensile strength, tear strength, seam slippage tests were done on all sample. Fabric

weight was determined according to ISO 3801. For pH test ISO 3701 method was followed. Dimensional stability to wash on both warp and weft direction were determined according to ISO 6330,2A,60°C.Tear strength, tensile strength and seam slippage test both on warp and weft direction were determined according to ISO 13934-2, ISO 13937-1, ISO 13936-1 method respectively. For stretch and recovery test ASTM D-3107 was used. Spray rating was determined according to ISO method. Color fastness was assessed by international standards. The specific tests were used: ISO 105-C06(color fastness to wash), ISO 105-E04(Color fastness to alkaline and acid perspiration), ISO 105 X 12(Color fastness to rubbing), ISO 105-E01(Color fastness to water), ISO 105-B02 (Color fastness to light).

III.RESULTS AND DISCUSSION

A. Fabric Weight

Weight changes of the fabrics vary in a great range according to the applied finishing processes but thereis an increase trend for weight values because of chemical add on occurred after finishing processes, especially after non-iron finish with soft finish (Fabric code 2). Weight decrease was observed in Fabric Code 1(OWR+NI+SAN) than Fabric Code 3(OWR+ SAN). Weight increase in Fabric Code 1, Fabric Code 2,FabricCode 3 are respectively 2.3%, 6.88% and 4.26%.

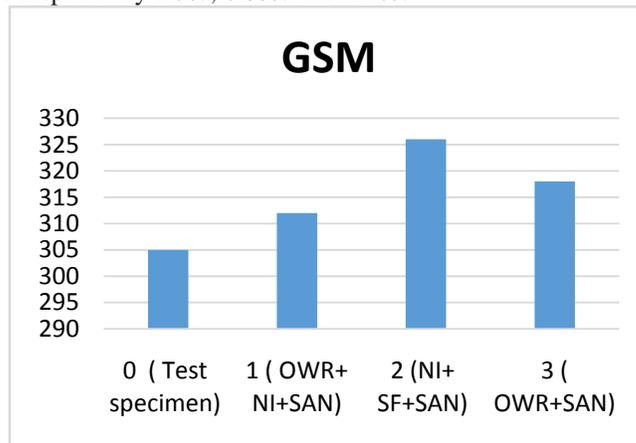


Fig 1: Effect of finishing processes on fabric weight (gm/m<sup>2</sup>)

B. Fabric pH

It is clearly seen that fabric pH decreases after each finish. The change of pH was higher in fabric code 2 (NI+SF+SAN). After this finish pH decreased by 0.13. (Figure 2)

C. Tensile strength

Fabric tensile strength values was seen to decrease significantly after all the applications. Warp way tensile strength is higher than weft way strength except fabric code 3. And difference between strength in warp and weft direction is higher in fabric code 2 as seen in figure 3.

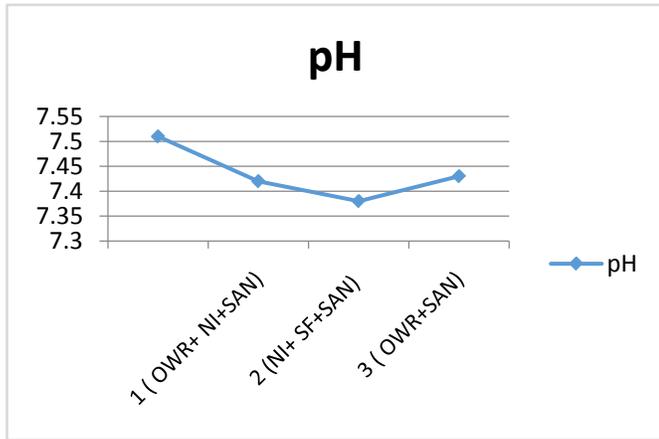


Fig 2: Effect of finishing processes on pH of fabric

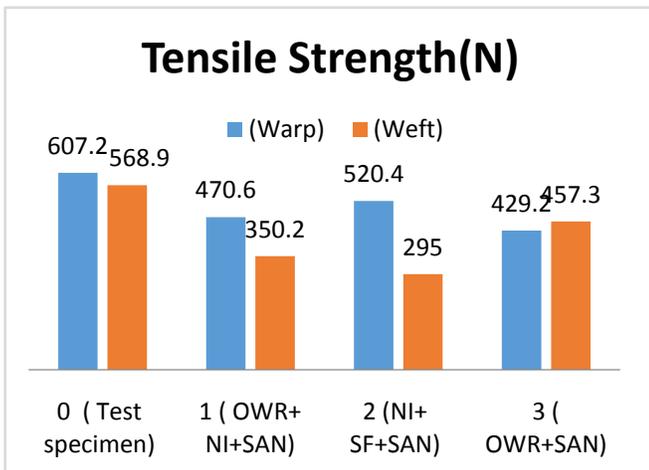


Fig 3: Effect of finishing processes on tensile strength of fabric

**D. Tear strength**

After all finishing process tear strength was seen to increase than

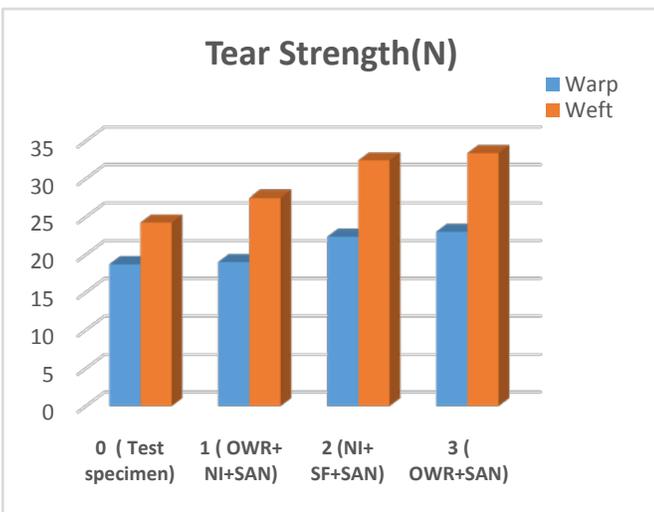


Fig 4: Effect of finishing processes on fabric tear strength

the test specimen. Tear strength is the highest in fabric code 3. Tear strength in warp increases in fabric code 1,2,3 consecutively 1.6%, 19%, 23%. Tear strength in weft increases in fabric code 1,2,3 consecutively 13%, 33%, 37%. This may be because the threads group closer together more in finished fabric under the force of the tearing agency. [3]

**E. Spray rating**

Spray rating tests were done on the fabric with OWR finish only. It is seen that fabric with only OWR finish has better spray rating than fabric with OWR and non-iron finish altogether.

	Before Wash	After 1 Wash	After 3 Wash	After 5 Wash
1 ( OWR+ NI+SAN)	5	3	2	2
3 ( OWR+SAN)	5	4	3+	3

Grade Description: [4]

1. Complete wetting of the whole of the sprayed surface
2. Wetting of more than half the sprayed surface
3. Wetting of the sprayed surface only at small discrete areas
4. No wetting of but adherence of small drops to the sprayed surface
5. No wetting of and no adherence of small drops to the sprayed surface.

**F. Stretch and Recovery**

Elongation, growth and recovery of all the specimen were measured after the finishing processes, and again after washing (normal wash). All the findings are shown in the graphs below. From the graphs of elongation and growth, it has been clearly seen that both the properties have increased after washing, though increase in growth is not very expected properties in fabric.

After washing of the finished fabrics, elongation increases because of shrinkage and tends to more stretch. On the other hand the graph of recovery shows the decreasing manner in after wash samples. Fabrics which are treated with non-iron finish i.e. fabric code 1 and 2 pose better performance than the other. However fabric code 2 i.e. the fabric with non-iron and soft finish shows overall good performance, as this fabric has comparatively better recovery properties with good elongation and low growth than the other finished fabrics after washing.

Fig 5: Effect of finishing process on elongation properties

G. Skewness

From the graph it has been seen that specimen 1 which has both OWR and NI finish shows only 0.50% skewness after the finishing process.

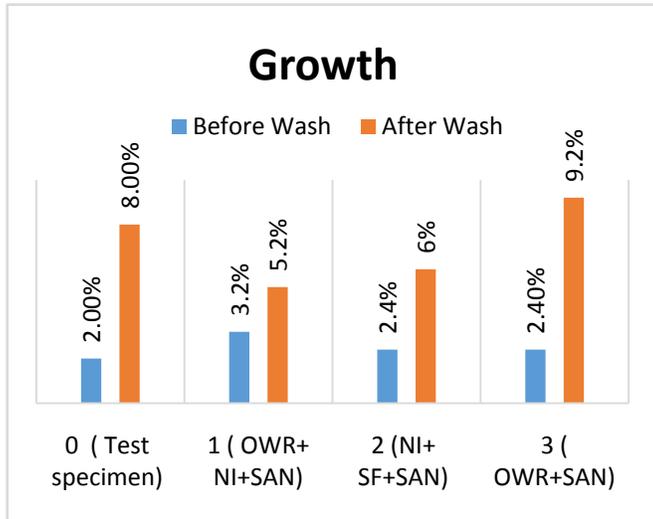


Fig 6: Effect of finishing processes on growth of fabric

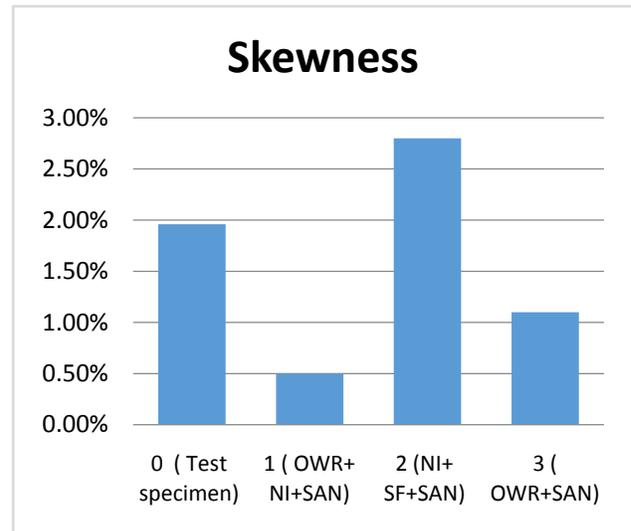


Fig 8: Effect of finishing processes on skewness

Specimen 3 which has only OWR finish also shows low skewness property. On the other hand specimen 2 which has NI and SF finish shows comparatively higher skewness (2.80%) than the test specimen (1.96%).

H. Dimensional Stability to wash

This property of fabric is one of the most important requirement for commercializing a finished fabric. From this experiment, it is seen that fabrics with non-iron finish shows low shrinkage and NI finish with OWR finish makes the fabric the most dimensionally stable.

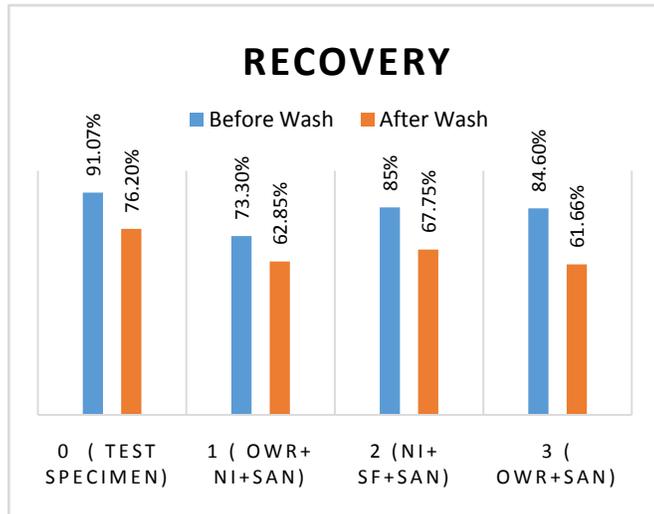
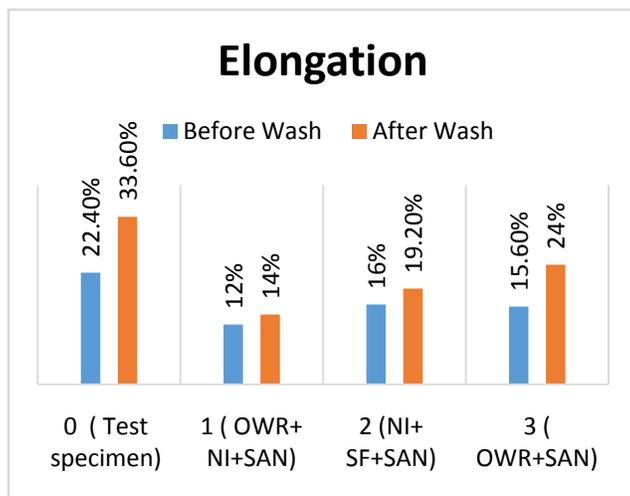


Fig 7: Effect of finishing process on recovery



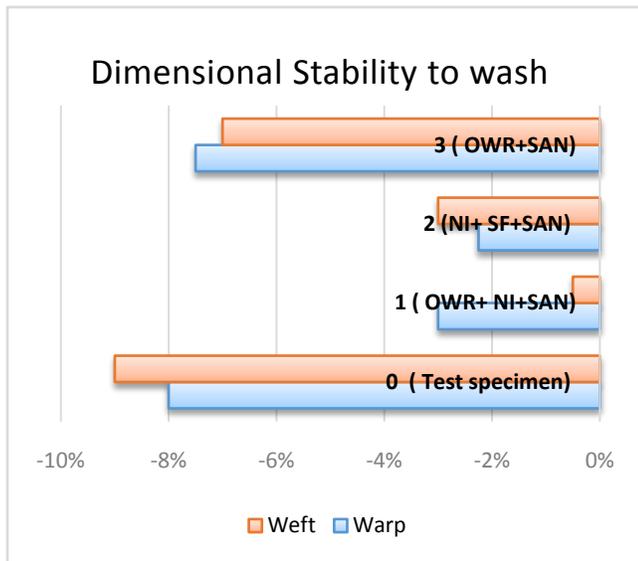


Fig 9: Effect of finishing process on dimensional stability of fabrics.

I. Color Fastness

The rating of color fastness does not show significant difference after different finishing. But it is seen that wet rubbing fastness and color fastness to wash improve a little after NI finish. Here 5=excellent,4=good, 3=Average, 2=Poor, 1= Very poor.

		0 (Test specimen)	1 (OWR+NI+SAN)	2 (NI+SF+SAN)	3 (OWR+SAN)
Color Fastness to Rubbing	Dry	4-5	4-5	4-5	4
	Wet	3-4	4	4	3
Color Fastness to Washing	Color Change	4	4-5	4-5	4
	Color Stain	4-5	4-5	4-5	4-5
Color Fastness to Water	Color Change	4-5	4-5	4-5	4-5
	Color Stain	4-5	4-5	4-5	4-5
Color Fastness to Perspiration	Color Change (Acid)	4-5	4-5	4-5	4-5
	Color Stain (Acid)	4-5	4-5	4-5	4-5
	Color Change (Alkaline)	4-5	4-5	4-5	4-5
	Color Stain (Alkaline)	4-5	4-5	4-5	4-5

V.CONCLUSION

From the finding of study it can be summarized that fabric properties changes after different finish. According to the results, finishing process groups on mechanical properties were determined as statistically significant. More detailed conclusions are summarized below:

Fabric weight gaining was the maximum for fabric with non-iron and soft finish together (fabric code 2). Tensile strength value is affected more in weft and tear strength values increases for all finishes may because the threads group closer together more in finished fabric under the force of the tearing agency. Resin treatment created a significant tensile strength loss in weft direction.

If fabric code 1(OWR+NI+SAN) and fabric code 3 (OWR+SAN) are compared in case of spray rating, it was seen that fabric with OWR and NI finish altogether shows low spray rating than fabric with OWR finish alone. However fabric code 2 i.e. the fabric with non-iron and soft finish shows overall good performance for stretch and recovery, as this fabric has comparatively better recovery properties with good elongation and low growth than the other finished fabrics after washing. Due to NI finish shrinkage was seen significantly low in fabric code 1 & 2 and color fastness properties does not vary significantly due to different type of finishes.

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# Effect of Computer Aided Instructions (CAI) on Senior Secondary School Students' Retention in Mathematics in Makurdi Metropolis of Benue State, Nigeria

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**Abstract-** This study ascertained the effect of Computer Aided Instructions (CAI) on students' retention in mathematics at the senior secondary school level with the sole purpose of reducing the failure rate in specific topics proven to be difficult to pass in Mathematics. The topics considered includes; Sequence/Series and Quadratic Equations. The study adopted the quasi-experimental method so as to observe the difference between the CAI teaching method and the traditional teaching method. A sample of 50 students from SS2 were selected from two (2) different schools with similar academic standard with a number of 25 each representing the two methods. An achievement test (SSQAT) with 40 test items was developed covering the two topics with 20 test items for each topic. The groups were administered a pre-test which showed that there was no significant difference between the groups after which they were taught in a span of four weeks and a post-test was administered at the end. After three weeks, same test was administered to obtain data for students' retention. Data analysis was done based on the results the retention test and the analysis was done using mean, standard deviation and t-test. A significant difference was found in the mean retention scores between the two groups in favour of the experimental and a significant difference also occurred in retention between boys and girls of the experimental group in favour of the boys; implying that the boys retained better with CAI. It can be concluded that this study provides some evidence of the usefulness of CAI in the teaching of Mathematics and promises to be a productive and effective media of instruction for better retention of mathematical concepts and improvement of students' achievement in Mathematics.

**Index Terms-** Computer Aided Instructions (CAI), Retention, Students, Secondary School.

## I. INTRODUCTION

Mathematics has a unique status in a school's curriculum as it was recommended as a compulsory subject by the education commission (1964 -66) and the national policy on education also emphasized its relevance as a foundational subject in analysis and logical reasoning. In spite of these, many students still find it difficult in learning Mathematics and actually fail mathematics. Bennett, Ross and Nillas (2011) defined retention as the ability to recall information about a topic or a concept over an extended period of time. Retention in Mathematics is a special

area of interest that should be given attention as much as achievement in order to optimally improve the overall performance of students generally. Bennet, et al. (2011) in the bid to improve students' retention in mathematics and science tried to find out the activities that can help students to retain information about mathematical concepts and how improvement in retention of the concepts learned can be achieved. It was gathered that the use of technology in the classroom can increase retention of mathematical concepts and individual work by students can also foster retention.

The use of computer in the classroom has given rise to Computer Assisted Instruction software packages for classroom instructional purposes. According to Umaru (2003), Computer Assisted Instruction is a program of instruction or package presented as computer software for instructional purpose. Therefore, the position of mathematics makes it necessary for the use of innovative pedagogical strategy that will enable teachers meet the challenges of teaching and learning of the subject especially in this era of information age.

To determine the effectiveness of CAI is crucial. Ramani and Patadia (2012) opined that there are many failures in Mathematics than any other subject, hence the need for a supplement along the classroom teaching. Considering the issue of gender difference and achievement and retention in mathematics by students, some researchers are of the view that gender gaps in mathematics achievement can be attributed to some factors such as cultural, socio-economic or parental influence (Kaino, 2004). Other factors also considered includes students' interest, self-esteem, curricular materials, students' attitude etc. (Ajai & Imoko, 2015).

Ursini, Ramirez and Sanchez (2006) with the aim to determine significant differences in students within the ages of 12 and 13 years between boys and girls, and by gender (masculine, feminine, androgynous and undifferentiated traits); carried out a research where 1056 students were given a mathematical test with 50.7% females and 49.3% males. A 14 multi choice items questionnaire was used to test students' mathematical knowledge. The result showed that no significant difference was found considering sex, however students with masculine traits did better in terms of achievement. The results from the study going by gender cannot be reliable because over time gender traits can change especially as girls' gets older and maturity sets in.

In the view to find out if there is gender gap in the achievement and retention of Mathematics, Ajai & Imoko (2015) carried out a research to find out if there is a significant difference in achievement and retention on a group of male and female students who were taught mathematics using the problem-based learning (PBL) approach and results from the study showed that male and female students taught algebra using PBL did not differ significantly in their achievement and retention scores.

One way to bridge gender gap in mathematics is to give them equal opportunity of learning via an interesting medium like the computer and it is in this view that this study imbibes the Computer Aided Instruction (CAI) in the teaching of Mathematics in the bid to improve students' performance generally as well as handle the issue of gender difference in retention of Mathematical concepts by students in the senior secondary schools in Makurdi metropolis, Benue State of Nigeria.

## II. STATEMENT OF THE PROBLEM

The study of mathematics can get students bored easily and students find it difficult to practice. Majority of the secondary schools in Makurdi have Computer Laboratories where students are privileged to learn with the computers and teachers as well are provided with assisted computer technologies for teaching base on demand. Yet, mathematical concepts are been taught traditionally. The concept of mathematics can be aided with visual images and pictures to simplify understanding and better retention which in turn would result in better performance by students. This study sees the need to find the effect that CAI can have on students' retention in mathematical concepts and it's also targeted at improving the overall performance of students in mathematics.

## III. RESEARCH QUESTIONS

1. What are the mean retention scores in SSQAT of students taught mathematics in the experimental and control groups?
2. What are the mean retention scores in SSQAT of male and female students in the experimental group?

## IV. RESEARCH HYPOTHESIS

1. There is no significant difference between the mean retention scores of students in the experimental and control groups.
2. There is no significant difference between the mean retention scores of the male and female students in the experimental group.

**Table 1 Retention Scores of the Experimental and Control Groups**

Group	N	Mean	S.D	t-value	Level of Significance
Control	25	19.88	3.95		Significant 4.00
Experimental	25	25.00	4.87		

3.

## V. METHODOLOGY

The study adopted quasi-experimental design. This is necessary in other to measure the effect of CAI on the students' retention as compared with the students who would be taught via the traditional method. The study was carried out in Makurdi Local Government Area of Benue State. The population of the study comprised of 5225 students from both private and government secondary schools in Makurdi L.G.A. The choice of SS2 students was based on the fact that the students must have been exposed to series of mathematical concepts. They are expected to have certain level of knowledge to be able to attempt the SSQAT. Also, majority of the students are preparing to sit for JAMB which is now computer based. The idea of exposing them to the teaching/learning of computer would encourage them to get trained in the use of Computer and most of them have access to computer devices like handsets of which the CAI could be installed on for personal reading and practice at their leisure time.

The sample size for the study consists of 50 students from two different schools with a class of 25 each from a school. The two secondary schools were selected in a non-random approach based on Teachers' access by the researcher and availability of functional computers/information technology as required for the CAI. The instrument used for the study was the Sequence and Series/ Quadratic Equation Achievement Test (SSQAT) that had a 40 multiple choice objective items with four options. To obtain a pre-test data, students were given the pre-test assessment that lasted for a day. After which different methods of teaching were adopted for the schools. The experimental used CAI while the control used the lesson plan in the conventional way. Participants were exposed to 40 minutes of teaching the topics twice a week for four weeks. At the end of the treatment, the same SSQAT was administered as the post test and the scores obtained provided the post-test data. Three weeks later, the same test SSQAT was administered to these same category of students for both the experimental and control groups and the scores obtained provided data for the retention test. The research questions were answered using mean and standard deviation while the formulated hypotheses were tested with two tailed t-test at 0.05 level of significance.

## RESULT AND DISCUSSION

### Research Question 1

What are the mean retention scores in SSQAT of students taught mathematics in the experimental and control groups?

Table 1 indicates clearly that the mean achievement scores for the control and experimental groups are 19.88 and 25.0 respectively. The mean difference of 5.12 in the test suggests some huge difference in terms of students' retention scores in SSQAT. This implies that the students taught mathematics using CAI demonstrated a greater retention capacity than those from the control group.

**Hypotheses 1**

There is no significant difference between the mean retention scores of students in the experimental and control groups.

Table 1 indicates clearly that the mean achievement scores for the control and experimental groups are 19.88 and 25.0 respectively. The mean difference of 5.12 in the test suggests a difference in terms of students' retention scores in SSQAT. This

**Table 2 Retention Scores of Boys/Girls in the Experimental Group**

Group	N	Mean	S.D	t-value	Level of Significance
Girls	11	23.63	4.05	2.41	Significant
Boys	14	25.86	5.17		

Table 2 clearly shows the mean retention scores for the girls is 23.63 while that of the boys is 25.86. There exists a mean difference of 2.23 in favor of the male students. The values of the standard deviation were 4.051 and 5.71 for the females and males respectively. The mean difference shows that the boys did better in the retention test than the girls.

**Hypothesis 2**

There is no significant difference between the mean retention scores of the male and female students in the experimental group.

Table 2 shows that the t-value calculated for the mean scores in the retention test for the boys and girls in the experimental group is 2.413 which is greater than the critical value of t (2.069). It is thus significant at 0.05 level of significance. Hence, the hypothesis of no significant difference in the retention scores of the male and female students is hereby rejected while the alternative hypothesis of a significant difference between the male and female students is accepted. This indicates clearly that the boys exhibited better retention capability than the girls in the SSQAT retention test.

**VI. DISCUSSION OF FINDINGS**

The results from table 1 indicates that there is a significant difference in the mean retention scores between the experimental and the control group. The mean scores from the experimental and control groups are 25.0 and 19.88 respectively. The t-value calculated for the mean scores is 4.0 which is greater than the critical value of t (2.0106). This suggests a significant difference in the mean retention scores at 0.05 level of significance. From these findings, it can be concluded that the students taught with CAI did better in the retention test than those taught in the

implies that the students taught mathematics using CAI demonstrated a greater retention capacity than those from the control group.

Table 1 also shows that the t-value calculated for the mean scores is 4.0 which is greater than the critical value of  $t = 2.0106$ . This suggests a significant difference in the mean retention scores at 0.05 level of significance. Thus the null hypotheses of no significant difference in the mean scores of the experimental and control groups is rejected implying that the alternative hypothesis is accepted.

**Research Question 2**

What are the mean retention scores in SSQAT of male and female students in the experimental group?

traditional way; hence, the study have provided evidence of the usefulness of CAI in the teaching of Mathematics and promises to be a productive and effective media of instruction for better retention of mathematical concepts and improvement of students' achievement in Mathematics. This study agrees with Bennett, Ross & Nillas (2011) that the use of technology in the teaching of mathematical concepts enhances students' retention.s

The results from table 2 also indicates a significant difference in the mean retention scores between the boys and the girls in favor of the boys. This goes on to say that the boys did better in their retention capacity than the girls when taught with CAI. This finding shows that the boys related very well with the CAI; hence were able to perform better in the retention test. There are other researchers that of this same notion that the boys retain better when taught mathematics than the girls (Asante, 2012; Ajai & Imoko, 2015).

**VII. CONCLUSION**

The significant difference in the mean retention scores in favor of the experimental group concludes that a strong relationship exists between the use of CAI and students' performance in Mathematics. The study also found that the boys from the experimental group retained better than the girls. In conclusion, CAI needs to be properly harnessed to make learning interesting and hard to forget and should be embraced in the teaching of Mathematics.

**VIII. RECOMMENDATIONS**

1. Schools should make personal efforts to provide alternatives for power supply and encourage students in the learning of computers because for individualized

CAI learning to take place, students are required to be computer literate and should have no phobia in operating the computer.

2. More attention needs to be paid on this study in exploring more depths of CAI in various topics in Mathematics.
3. There is a need to modernize senior secondary schools classrooms by making provisions for a projector for each class and also avail computers to teachers to facilitate active learning.

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# Impact of Globalization on Changing Gender Roles: A Case of Gujrat

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**Abstract:** The main purpose of the present research was to analyze the impact of globalization on changing gender roles: A case of Gujrat. The data was analyzed by using the available literature, archives, published research papers, journals, published reports as well as online authentic material which is published by government and non-governmental organizations. A thematic analysis was done to draw the final results and conclusion. Different themes were attributed through review of literature and available resources with reference to research question and objective of the present research. It was concluded from the present research that globalization plays an important role in changing gender roles. The change in different roles has significant effect on society's institutions like family, economic institution and job structure.

**Keywords:** globalization, modernization, gender, gender roles, secularization

## 1.Introduction

### 1.1 Background of the Study

Globalization is the process of acceleration and intensification of interaction and integration among the people, companies, and governments of different nations. This process of globalization has effects on human well-being, on the environment, on culture, and on economic development and prosperity of societies across the world (Rothenberg 2003).

This comprehensive definition takes into account the many causes and effects of the process, and, most importantly, leaves room for debate and discussion of the values that different people from all over the world bring to the table (Rothenberg 2003).

Globalization has offered much type of employment benefits to developing countries. Globalization enhances employment and earnings in developing countries because of foreign investment or increases in the value and quality of a developing country's export products (Edmonds,2002).

### 1.2 Effects of Globalization

The globalization process has changed the gender roles in all over the world. Globalization has reshaped many issues, international relations population growth, development, human rights, the environment, labor and health care system. It has increased awareness of individuals of the profound ways in which policies and practices in one region can affect the livelihood of the people living in other region (World Bank 2011).

### 1.3 Gender Roles in Pakistan

Gender roles are assigned to individuals through socialization. Throughout the childhood we socialize our children by customs, traditions, culture and institutions. Female are socialized in a way that they are supporter for society. They are less nourished than

men, less healthy more vulnerable to physical violence and sexual abuse. Agents of socialization play a vital role in this process in which includes family, peer group, school and environment. They all teach the individual how to behave in society and what are his or her roles in society to perform.

#### **1.4 Problem Statement**

The main purpose of the study is to evaluate gender roles in district Gujrat due to modern technology, education, fashion, modernism and media. These changes in roles have great impact on society's structure. This study will examine these changes with respect to globalization.

#### **1.5 Objective of the Study**

To analyze the impact of globalization on changing gender roles in district Gujrat.

#### **1.6 Objective of Question**

Does globalization effect gender roles in Gujrat?

Does any element of globalization effects gender attitude toward roles?

Does there any distinction of effects on gender role through process of globalization?

#### **1.7 Significance of the Study**

Gender role has significant effects on society. This study examines the changing job structure and its impact on society. With the change in roles our institutions are also effected like family structure, education sector, peer group and even practices of everyday life. This study examines the effects of all these changing institutions and roles on society.

### **2. Review of literature**

Globalization effecting overall job structure of society, economic and social patterns, socialization and education patterns etc. World Bank (2011) conducted a study on gender equality in which studied that the world has witnessed an enormous economic transformation over the past three decades, fostered by increasing global flows of goods and services, technology and information. These changes have transformed the way domestic and global markets and institutions function, and have thus changed the economic landscape for individuals, households, firms, and governments.

Nazreen (2005) concluded in "The effects of Globalization on women" women role in the labor force has changed from traditional agricultural and domestic roles to manufacturing and assembly production. According to him the overall effects of globalization have proven to be negative. Women becoming breadwinners in most households because male has lack of responsibility in household. Young females also financially supporting their parents and fellow siblings. Globalization changed the overall responsibilities of male and female in household, now female are more responsible for the survival of the family. In this change NGOs play a very important role.

Stephanie (2006) shows in "Globalization effects on gender equality" that the gender equity in well-being is improved but not unambiguously so. Some of the countries have experienced decline in individual indicators of well-being and there is a significant

worsening of women experience of unemployment relative to male. Growth since 1970 is not shown to improve gender equity. Economic growth negatively effecting to female than male population ratio and positive effect on relative female to male mortality rates. Economic growth under liberalized conditions appears to have contradictory and in some cases worryingly negative gender effects. Unraveling those conditions is a complex task and country specific condition play a specific conditions probably plays an important role.

### **3. Martials and methods**

For the present study researcher focused on the main objective to analyze the “Impact of globalization on changing gender roles”. Researcher reviewed the available literature, archives, published researcher papers, journals, published reports as well as online authentic material which is published by government and non-government. A thematic analysis was done to draw the results and conclusion different themes were attributed the review of literature with reference to research question and objective of the present research. The themes that are drawn on the biases of the literature reflect the changes that occur in this modern world with the impact of globalization.

### **4. Thematic analysis**

Themes include impact of globalization on changing gender roles, a case of Gujrat.

- **Women role**
- **Men role**
- **Changing patterns**
- **Change in occupation**
- **Change in decision making at household**
- **Change in decision making at work level**

#### **4.1 Women role**

The culture of female employment was based on formal labor, housework, and informal sector production. There is only a small proportion of women work in export factories matched to the entire female population. Most work in agriculture, complete housework, or are employed in the informal sector. Females in old nations are imperfect in society by patriarchal control. These societies claim that female labor is an allowance of their household chores. This ideology is interwoven in the capitalist economy to justify women’s subordination on the global assembly line, in the home and informal sector (Ward 1990).

Regardless of which sector of occupation women are working in, they are given limited access to resources and consultant over their work. Informal sector work delivers the intermediate link between formal waged labor and honorary house work in that it is unprotected waged labor the survival and preservation of families (Ward 1990).

Employment openings within the informal sector are also stratified conferring to gender. Like the formal sector, males hold managerial positions, while females are simply commissioned workers. Women perform informal assemblage work in their homes or factories as methods of survival. Working in the home allows women to care for children and to recollect control over the profits of their labor (Ward 1990).

Most women who indicate this option are housewives who do not accept enough money from their husbands to pay for the basic requirements for their family's survival. These women cannot seek formal sector employment due to their family accountabilities within the household. Informal or domestic jobs also provide a survival strategy for women commerce with husbands who don't want to give enough of their wages to provide for the families. Although women may feel a sense of authorization, their wages are substantially low in judgment to their male counterparts. Also women have the lowest shops, are the least able to compete and are subject to more government goings-over than men (Ward 1990).

The glass ceiling also happens in developing nations. Women are given a flavor of independence that does not permit them to ascend to the same managerial positions as men. The fact that male managers believe that garment congress is an extension of female work at home, causes administrators to stigmatize all women as labors rather encourage them to managers. They are narrowed to these positions because of sexual category roles and expectations. However, unemployed men refused to contribute in their wives' informal work unceremonious work because they felt they could be called missing at any time for a waged job (Ward 1990).

These double customary cause women in developing nations to develop a dual role of survival. The informal-sectors enable women to maintain these roles without the dependence of her husband's assistance.

#### **4.2 Men role**

Greater economic integration has also had an impression on workers in the advanced world. It has increased the mandate for skilled workers, comparative to that for unskilled ones. And this shift was translated into greater wage inequality in the United States and greater unemployment among the unskilled. Impacts were larger between men than among women because men were concentrated in the manufacturing and occupations. Higher trade openness accounts for 12 to 33 percent of the occupation losses in manufacturing and for about 20 percent of the increase in the skill premiums through the 1980s and 1990s (Bacchus Nazreen 2005). Technological change also accounts for an essential share of the increase in skill premiums. Evidence of trade has impact on women's wages and employment is more mixed. Trade liberalization and overseas direct investment leading to the Shoring of average and high skill jobs may have also raised job insecurity. Workers in the United Kingdom in subdivisions with high foreign investment are more possible to report greater economic insecurity. In some cases, the impact of these variations reaches elsewhere the economic sphere. The notion of men as the main wage earner has been challenged by the greater economic opportunities for women and the job destruction in male dominated zones these changes have often led to modification in the power balance in families (Bacchus Nazreen 2005).

#### **4.3 Changing patterns**

The impacts of change in the former communist countries are different, but complex and highly capricious. Restructuring of these humanities has often led to high unemployment between both women and men, but obstinately high unemployment among women. Entry into the world of global entrepreneurship has also meant a restoration or consolidation of traditional, capitalist gender, race, and class hierarchies (Bacchus Nazreen 2005).

Globalization has condensed the ability of women to find paid work that offers safekeeping and dignity. Although women's roles in the labor strength have changed from old-fashioned agricultural and domestic roles, to industrial and assembly production, the overall effect of globalization has confirmed to be negative. There are empirical privileges of women gaining more autonomy over their own salaries and a feeling of independence from old-fashioned gender roles in society especially in wedding and childrearing. Women are also attractive the breadwinners in most households because of the absence of male responsibility in the household. Young daughters are economically supporting their parents and parents and fellow siblings, while mothers are seeking informal work to provide for their children (Desai 2002).

Globalization has changed the intra household responsibilities for males and females, where females are given more responsibility over the survival of the family.

Males are no longer becomes the provider yet they have more opportunities for financial and social progression in society. Although female responsibilities have increase, SALs implement by the IMF are gender unfair towards males. They fail to include females in managerial and upper level positions. The limited forward-thinking of women in the formal sector shows a great disregard for their social and economic everyday jobs within developing nations. Female labor is not rewarded in relative to the impact they have on society. Therefore, women's work continues to be stigmatized as lower, in comparison to males work, regardless of their increased responsibilities in society (Desai 2002).

#### **4.4 Change in occupation**

The establishment of various NGOs around the globe and the cooperative efforts of these organizations have enhanced the lives of women and occupation structure in all over the world.

The U.N. Decade recognized the prominence of female labor in developing nations and the fact that economic policies fail to statement the needs of females. Representatives from NGOs agreed that global women's movement should be established to reduce the inequality facing women in these nations and to advance the development of women in society (Desai 2002).

#### **4.5 Change in decision making**

The literature also states that there are two long term goal of feminism, the achievement of women's equality, dignity, and freedom of choice through women's power to control their own lives within and outside the home and the removal of all forms of discrimination and oppression through the creation of a more just social and economic order, nationally and globally (Bunch and Carrillo 1990).

In regards to formal and informal occupation, women's work should be satisfied with wages and benefits that would enable them to sustenance themselves and their family. Creating a just social and financial order will allow more women to further their education and to get managerial and technical positions. Allowing women who have operated in a Participation in decision making at households level (Bunch and Carrillo 1990).

Global changes also affect individual gender relations and identities. For some women, increased chance for paid employment may mean greater autonomy and parity in personal life, or avenues out of oppressive relationship (Bunch and Carrillo 1990).

Theconcept of gender socialization can be operationalized in three distinctive ways, as forms of transmission from parents to children, which depend on personal attitude and resources and also on family life. Technically, I have used path inquiry models to measure slashes of gender attitude dimensions from their categorical or ordinal component variables (World Bank 2011).

First, the paper shows that it is possible to operationalize these diverse dimensions using the

BHPS, and that there is indeed quite good correlation between these types of gender attitudes; this implies that household life and relationship are very important and sometimes more important than fundamental variables (World Bank 2011).

Secondly, if one considered the relative importance between interpersonal and structural factors influencing gender socialization process, the evidence would powerfully suggest that it is the former rather than the concluding that is of greater explanatory power.

An interesting further consideration is that a cross gender relationship between fathers and daughters, mothers and sons has emerged as significant in determining traditional and nontraditional gender brashness. During puberty the identification with gender models goes through different relational mechanisms, which for example in this case pressure more the relationship with the differing gender.

The relation with the same gender appears to have a strong reinforcing power on an already existing traditional assertiveness; the

relation with the parent of opposite sex instead could be a strong factor in reducing stereotyped attitudes. Probably because gender in the family is a relationship and could assume different features, sometimes a challenge.

#### **4.6 Participation in decision making at work level**

Globalization has had gendered influences on the lives of women, men, and their families. The following is a very short-term summary of some of these effects. One of the most visible impacts has been the increased participation of women in the waged labor market almost everywhere, except in the former socialist countries, while for men labor market involvement has decreased (Standing 1999).

At the same time, Standing (1999) and others argue, the old full time, secure, with benefits kind of employment is eroding as new “feminized” jobs, low paid, temporary or part-time, insecure, and without paybacks are created. However, these new jobs are often much improved than no jobs and they do advance the lives of many of the women who have them. In addition, in many countries educated middle class women have had in the 1980s and 1990s increased opportunities for professional and decision-making employment, contributing to increased affluence for their families, while worsening class differences among women (NIKK 2002)..

Another general impact is that unemployment has also risen around the globe (Standing 1999), with some indications that men’s unemployment rates are rising to the levels of those of women. Inequality and dire poverty are gendered outcomes of globalization. Inequality and poverty contribute to the apparent increase in the international trafficking in women for prostitution and trafficking in both women and men for other kinds of labor (NIKK 2002).

#### **5. Conclusion**

Women and men roles in the labor force have changed from traditional agricultural and domestic roles, to manufacturing and assembly production the overall effect of globalization has proven to be negative in newly developing countries, it suits best the highly industrialized nation in the west as in the prevailing conditions. It has inevitably reduced the freedom of choice for the newly independent poorer nations of the world. To conclude this discussion, it can be said that globalization is reinforcing the changing gender roles in Pakistan, both diversifying its economic base and sharpening the gender roles. Globalization has changed the household responsibilities for males and females where both male and female are responsible for the survival of the family. The following section delves into this issue. Globalization, with all its high technology, is able to penetrate and get into non-Western cultures. The role of MNCs and TNCs in promoting and enhancing the process of globalization has been discussed. Globalization is at heart nothing but the expansion of Western models of behavior of socialization, organization, exchange in the market and elsewhere to other parts of the world. Globalization brought new challenges to traditional societies. This is particularly true in technology and organization. The electronic and print media are at the service of those attempting to changing roles. Due to these changing roles we are facing problems in our family, education and employment. The downside of globalization is therefore a source of real challenge for Pakistan and other developing countries

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# Design of Jig for Alternator Stator prepared by Glue Stacking

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**Abstract-** Alternator is a motor used in aero applications where speed matters. It consists of two parts named as stator and rotor. Stator is prepared by silica steel laminations to increase the motor efficiency. Holding of individual glued laminations is mandatory to prepare a stator. This project is deals with the design of a special purpose tool, can be called as jig, which can hold all the laminations and stack them in a skewed manner in order to reduce torque ripple in alternator. Jig was designed by considering single lamination dimensions and stack height. Modeling was done using CATIA software and fabrication by using CNC machine.

**Index Terms-** Alternator, Silica steel laminations, Jig, Torque ripple and CATIA.

## I. INTRODUCTION

An Alternator is an electrical generator, converts mechanical energy to electrical energy in the form of alternating current, prepared by silicon steel laminations. A laminated core for the stator/rotor has a higher resistance than a non-laminated one with the same number of domains. The core is laminated to reduce eddy current losses to a minimum as they interfere with the efficient transfer of energy. Laser cutting machine is used to get the different types of laminations from the silicon steel sheet. Normal straight rotors will face the problem of Torque Ripple which causes the motor to stall for some time during working conditions. If the rotating part of motor is made skewed to the stationary part it will minimize the torque ripple which increases the efficiency.

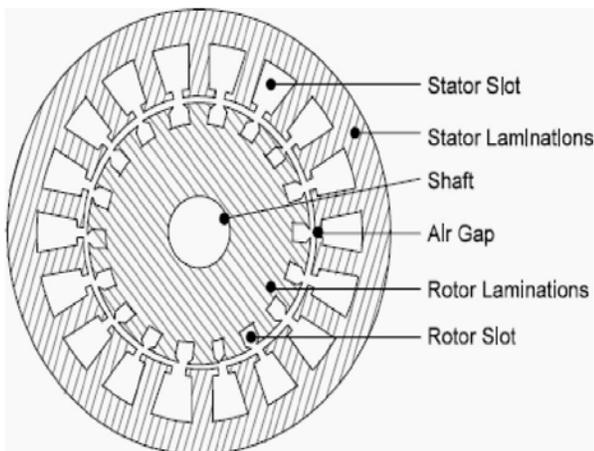


Figure 1: Construction of Motor

## II. DEFININING THE PROBLEM

Alternator is prepared by individual laminations, stacking of laminations can be done by applying the specified glue on one side of all individual laminations and place all laminations one on the other. Keep this stack in muffle furnace for 4 hours to reach the curie point temperature and allow them proper adhesion. [1]Holding the laminations can be done by placing them in a jig, it will guide the laminations to make skewed product. Lamination details and stack height are required to design the jig. The details mentioned below:

- Laminations were cut by Laser cut machine as per profile.
- Outer diameter-114mm, inner diameter-76mm, no. of slots 48
- Skew angle –  $14^{\circ}$
- The actual lamination thickness 0.5mm thickness.
- Stack height- 21mm (No. of Laminations required-42)

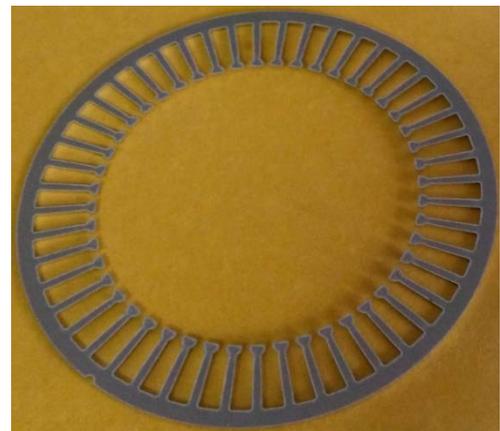


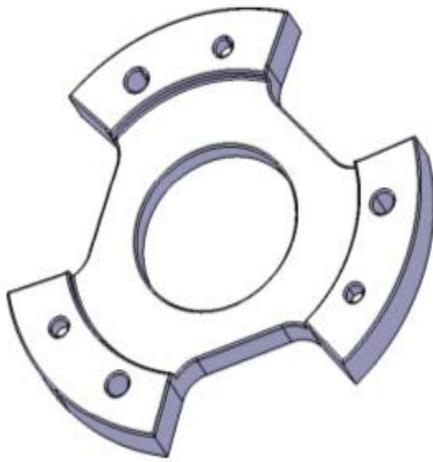
Figure 2: Silica Steel Lamination

## III. DESIGN OF JIG

[3]The following parts are required to fabricate the complete JIG.

1. Bottom Plate
2. Top plate
3. Skew Mandrel
4. Mandrel Support
5. Bolts, nuts and Spring

### 4.1 Bottom Plate:



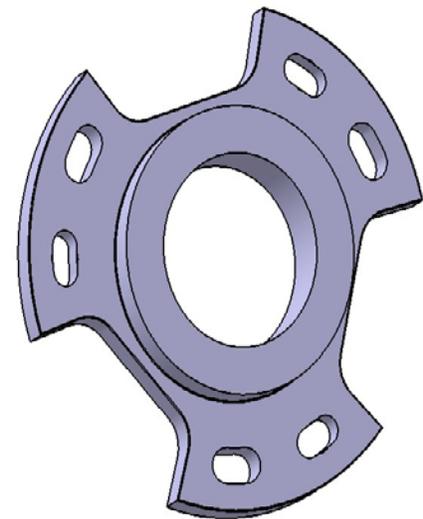
**Figure 3: Design of Bottom Plate**



**Figure 4: Fabricated Bottom Plate**

It requires a base in order to place required no of laminations one on the other and the bottom plate is serving the same. Bottom Plate as shown in Figure3 &4 having inner circle diameter 74mm which is slightly lesser than the ID of laminations and outer circle diameter 114 mm which matches with the OD of laminations and this plate has 3 pads those are equal in dimensions. This plate has slots with 164mm distance from center with 5mm diameter. It is designed in such a way that it should hold the entire setup and given slots for the bolts to tighten from the bottom side.

#### 4.2 Top Plate:



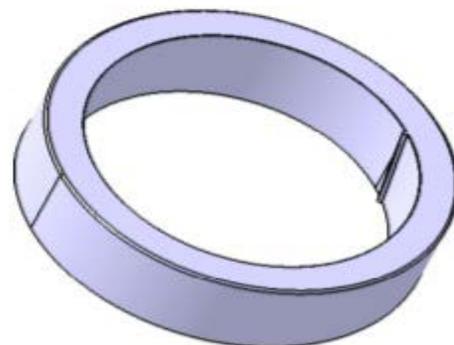
**Figure 5: Design of Top Plate**



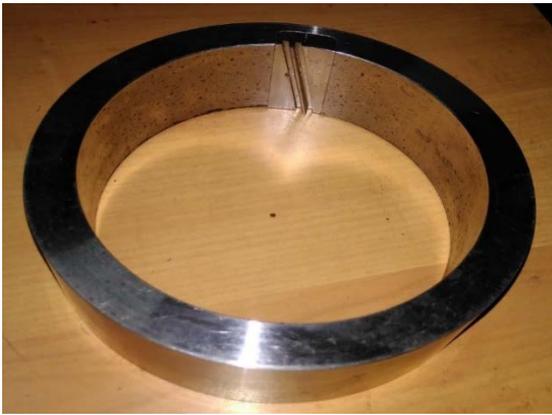
**Figure 6: Fabricated Top plate**

Top plate [Figures 5 & 6] purpose is same as bottom plate as mentioned. Top Plate and Bottom Plate having same dimensions but the thickness of circle is more than the bottom plate. This top plate is designed in such a way that applied tightening torque is equally distributed on the laminates. And it is given slots for the bolts.

#### 4.3 Skew Mandrel:



**Figure 7: Design of Skew Mandrel**

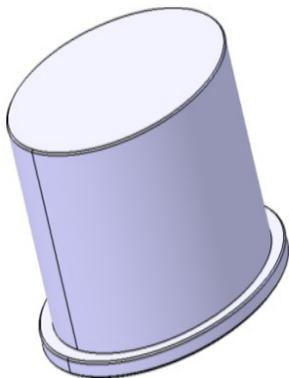


**Figure 8: Fabricated Skew Mandrel**

The purpose of the mandrel is to allow the laminations to stack and guide them in desired skewed manner. Skew Mandrel as shown in Figure7 &8 having inner diameter 113.7mm and outer diameter 140mm and it is having Skew of  $14^{\circ}$  angle. Skew Mandrel is designed in such a way that ID of mandrel is matches with the OD of the laminates. Key way has given to inner side of the mandrel and it is to serve the purpose of skew stacking.

#### 4.4 Mandrel Support:

Mandrel Support as shown in Figure 9 having outer circle diameter 85mm and inner circle diameter 75mm. The length of the outer circle is 4.5mm and inner circle is 60mm. Support Mandrel is in the shape of cylindrical for the purpose of supporting the laminates from the inner side.



**Figure 9: Design and Fabricated mandrel support**

#### 4.5 Bolts, nuts and Springs



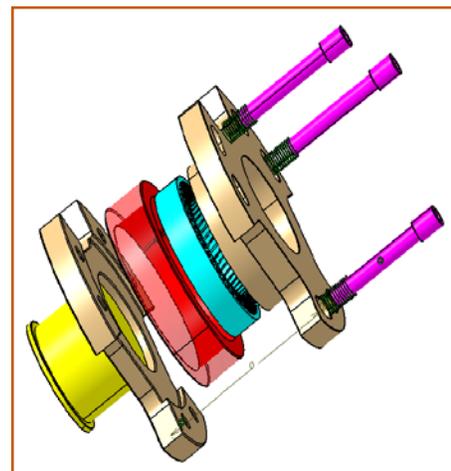
**Figure 10: Design of Bolt and spring**

Bolts and springs designed as per the requirement and used for the purpose of tightening.

#### IV. EXPERIMENTAL WORK

[5]Glue stacking of laminations was done with the following procedure.

- Collect the laminations from the laser cutting machine.
- Make sure that all the laminations are of same orientation before applying the glue.
- Prepare glue composition, mix it in the ratio as mentioned on catalogue
- Apply the glue on the one side of all the lamination and allow them to dry by keeping at room temperature for 24 hours.
- After complete drying of glue on the laminations, place the laminations in jig and assemble as shown in below figure.



**Figure 11: Assembly of Jig**

- Tighten the jig and place it in furnace at temperature of  $121^{\circ}\text{C}$  for 5 hours.
- And disassemble all the parts and take out the stator prepared by glue stacking of laminations.



Figure 12: Disassembly of Jig [5]

#### V. RESULTS AND CONCLUSIONS

- Design of all the necessary parts for the jig was done and fabricated.
- Assembly of all the parts by placing laminations in mandrel was successfully completed and there is no interference in the design.
- Experiment of glue stacking of laminations for preparation of alternator stator was carried out and results were satisfactory.

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# On the Regression Discriminant Analysis (RDA), and its Identical Relationship to the Fisher's Discriminant Analysis

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**Abstract-** The linear regression has been studied particularly with respect to its identical relationship to the Fisher's Discriminant Analysis (FDA). In this paper, we prove that the coefficient vector of the least squares regression is identical to the vector of coefficients of the Fisher's Discriminant Analysis. We therefore refer to the classification procedure using the least squares regression as Regression Discriminant Analysis (RDA). We further carry out empirical investigations using both real world and simulated datasets, to show that a classification procedure based on both RDA and FDA are identical.

**Index Terms-** Machine learning, Regression based binary classification, Linear discriminant analysis, Statistical learning

## I. INTRODUCTION

Regression and classification are two prediction tools, since both tools involve the use of input to generate output[1]. The output, otherwise called predictions are dependent on the input which is either a single explanatory variable or a set of explanatory variables. Both regression and classification differ in their output. For instance, the output of regression consists of continuous response variables, whereas discrete response variables constitute the output of classification.

As tools for prediction, a model or algorithm is involved and in order to carry out prediction, the model is necessarily trained given a set of data [2]. Training here involves making informed choice of a prediction function that best describes a relation between the input and output. To access this function, we often resort to the use of training and test sets. A training set is used to discover potentially predictive relationships, and a test set is useful to access the strength of the relationship [3].

Training of models and the assessment of their performances are often severally repeated before a function that optimally performs is finally obtained. An optimum performing function is the one that upon comparison with all similar functions, that describe a relation between the input and output, gives the smallest prediction error. Prediction error is the error that results from incorrect prediction of the output. As a statistic, it measures how well or badly a model has performed. We usually have preference for a function with zero or smallest prediction error in comparison with other similar functions.

Regression and classification as tools for prediction, have some characteristics that are commonly shared. For instance:

- There exists a matrix of input data, and vector of output required for training and testing of both regression and classification models.
- Since the dimension of the input data, in most cases is at least  $n \times 2$ , there can be concern for numerical stability of data in both cases.
- In instances where the input data is high dimensional, to obtain a regression or classification function that optimally performs may be a challenging task.
- Assessment of prediction tools is via prediction error, and the method of calculating such error depends on the prediction tool in question.
- Finally, we note that a very important characteristic is the fact that the equations describing both regression and classification functions can be similarly expressed. For instance, (1.1) and (1.2) are respectively regression and classification functions.

$$y = f(\mathbf{x}) \\ = b_1 x_1 + \dots + b_p x_p + b_0 \quad (1.1)$$

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$$\begin{aligned}
 z &= g(\mathbf{x}) \\
 &= \mathbf{w}^T (\mathbf{x} + \boldsymbol{\mu}) \\
 &= w_1 x_1 + \dots + w_p x_p + \mathbf{w}^T \boldsymbol{\mu}
 \end{aligned} \tag{1.2}$$

Both functions have coefficient vectors respectively denoted by  $\mathbf{b}$  and  $\mathbf{w}$ , and p-dimensional explanatory variables. The constant terms are respectively  $b_0$  and  $\mathbf{w}^T \boldsymbol{\mu}$ . We can infer that (1.1) is a regression function where  $\mathbf{b}$  is a regression coefficient vector and similarly, (1.2) is a classification function. Let  $\mathbf{w} = \mathbf{d}^T \hat{\boldsymbol{\Sigma}}^{-1}$ , and  $\boldsymbol{\mu} = -\frac{1}{2}(\bar{\mathbf{x}}_1 + \bar{\mathbf{x}}_2)$ , where  $\mathbf{d} = \bar{\mathbf{x}}_1 - \bar{\mathbf{x}}_2$  and both  $\bar{\mathbf{x}}_1$  and  $\bar{\mathbf{x}}_2$  are class mean vectors for a two class classification problem. Also let  $\hat{\boldsymbol{\Sigma}}$  be a pooled covariance matrix for both classes, then (1.2) can refer to a Fisher's discriminant function. Hence,  $\mathbf{w}$  can be called a coefficient vector of FDA.

Assuming we further examine (1.1) and (1.2) it may be possible to find a situation where the two coefficient vectors are at least proportional, and the explanatory variables exactly the same. In such a situation, one wonders if it could be possible that any informed alteration of say  $f$ , can be useful for predicting  $z$ , or vice versa.

In the light of these, and particularly considering the commonly shared characteristics, we are of the view that it is possible to use regression as a tool for classification. Thus, we propose a classification function based on the least squares regression, and claim that it is identical to FDA. Hence, we refer to it as Regression Discriminant Analysis (RDA).

## II. LITERATURE REVIEW

The logistic regression [4] is a foremost regression based classification procedure and it has been shown that when normality assumption is violated, it is superior to FDA [5]. If normality is assumed, the logistic regression is an alternative to FDA [6]. Conversely, the logistic regression differs from our main idea because it fits a nonlinear model to a linear combination of explanatory variables. In the case of RDA, our aim is to fit a linear model for classification based on the multiple regression.

One study that involves the use of multiple regression in discriminant analysis is due to [7], but the study considered a multi-class case. We are mainly interested in binary classification problem. Hence, the study carried out by [8] is of interest to us because it concerns a binary classification problem. It considers the relationship of the Minimum Squared Error procedure to the Fisher's Linear Discriminant. The authors showed that with the proper choice of the vector  $\mathbf{b}$ , say, the MSE discriminant function  $\mathbf{b}^T \mathbf{x}$  is directly related to Fisher's Linear Discriminant.

To prove their point, they assumed that we have a set of  $n$  p-dimensional samples  $\mathbf{x}_1, \mathbf{x}_2, \dots, \mathbf{x}_n$ ,  $n_1$  of which are in subset  $D_1$  labelled  $\omega_1$ , and  $n_2$  of which are in subset  $D_2$  labelled  $\omega_2$ . Further, they assumed that a sample  $\mathbf{y}_i$  is formed from  $\mathbf{x}_i$  by adding a threshold component  $x_0 = 1$  to make an augmented pattern vector. If the sample is labelled by  $\omega_2$ , then the entire pattern vector is multiplied by  $-1$ . Thus without loss of generality, the first  $n_1$  samples are labelled  $\omega_1$  and the second  $n_2$  samples are labelled  $\omega_2$ . The matrix  $\mathbf{Y}$  can be partitioned as:

$$\mathbf{Y} = \begin{pmatrix} \mathbf{1}_1 & \mathbf{X}_1 \\ -\mathbf{1}_2 & \mathbf{X}_2 \end{pmatrix}, \tag{2.1}$$

where  $\mathbf{1}_i$  is a column vector of  $n_i$  ones, and  $\mathbf{X}_i$  is an  $n_i \times d$  matrix whose rows are samples labelled  $\omega_i$ . They partitioned  $\mathbf{a}$  and  $\mathbf{b}$  correspondingly with

$$\mathbf{a} = \begin{pmatrix} w_0 \\ \mathbf{w} \end{pmatrix}, \tag{2.2}$$

and with

$$\mathbf{b} = \begin{pmatrix} \frac{n}{n_1} & \mathbf{1}_1 \\ \frac{n}{n_2} & \mathbf{1}_2 \end{pmatrix}. \tag{2.3}$$

They noted that this special choice of  $\mathbf{b}$  links the MSE solution to Fisher's Linear Discriminant. Define sample means  $\mathbf{m}_i$  and pooled sample scatter matrix  $S_W$  :

$$\mathbf{m}_i = \frac{1}{n_i} \sum_{\mathbf{x} \in D_i} \mathbf{x} \quad i = 1, 2 \tag{2.4}$$

$$S_W = \sum_{i=1}^2 \sum_{\mathbf{x} \in D_i} (\mathbf{x} - \mathbf{m}_i)(\mathbf{x} - \mathbf{m}_i)^T, \tag{2.5}$$

and plug into MSE formulation[9] to get

$$\mathbf{w} = a n S_W^{-1} (\mathbf{m}_1 - \mathbf{m}_2). \tag{2.6}$$

Finally, the authors noted that except for an unimportant scale factor, (2.6) is identical to the solution for Fisher's Linear Discriminant. Decision rule: decide  $\omega_1$  if  $\mathbf{w}^T (\mathbf{x} - \mathbf{m}) > 0$ , otherwise decide  $\omega_2$ , where  $\mathbf{m}$  is the mean of all the samples.

### III. DIFFERENT PROCEDURES

The main ideas expressed by [9] agrees with ours but our procedure for establishing the identical relationship between RDA and FDA differs. Prior to giving the relevant proof, we shall first define some datasets and give some notations.

#### a. Data and some notations

Let  $X_1 (n_1 \times p)$  and  $X_2 (n_2 \times p)$  be datasets for two populations  $\Pi_1$  and  $\Pi_2$ , and let  $n = n_1 + n_2$ . Let  $X = \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} (n \times p)$

denote the whole dataset, and  $H = I_n - (1/n) \mathbf{1}_n \mathbf{1}_n^T$  denote the  $n \times n$  centering matrix. In a similar way, let  $H_1$  and  $H_2$  denote the  $n_1 \times n_1$ , and  $n_2 \times n_2$  centering matrices respectively.

Let  $\bar{\mathbf{x}}_1$ ,  $\bar{\mathbf{x}}_2$  and  $\bar{\mathbf{x}}$  denote the sample means of  $X_1$ ,  $X_2$  and  $X$  respectively. Note that

$$\bar{\mathbf{x}} = (n_1 \bar{\mathbf{x}}_1 + n_2 \bar{\mathbf{x}}_2) / n$$

is a weighted average of the two class means. We also need the unweighted average

$$\mathbf{x}_{av} = (\bar{\mathbf{x}}_1 + \bar{\mathbf{x}}_2) / 2,$$

and the difference,

$$\boldsymbol{\delta} = \bar{\mathbf{x}}_1 - \bar{\mathbf{x}}_2. \tag{3.1}$$

#### b. Fisher's allocation rule

Several matrices are of interest in discriminant analysis:

$$T = X^T H X,$$

$$B = (n_1 n_2 / n) \boldsymbol{\delta} \boldsymbol{\delta}^T,$$

$$W = X_1^T H_1 X_1 + X_2^T H_2 X_2.$$

A classic result[10] states that

$$T = W + B.$$

The Fisher's allocation rule is based on Fisher's linear discriminant function given by:

$$f(\mathbf{x}) = \boldsymbol{\delta}^T W^{-1} (\mathbf{x} - \mathbf{x}_{av}).$$

The allocation rule in respect of a new input  $\mathbf{x}$  says: allocate  $\mathbf{x}$  to  $\Pi_1$  if  $f(\mathbf{x}) \geq 0$ , and to  $\Pi_2$  otherwise.

It is important to note that sometimes  $f(\mathbf{x})$  is constructed using  $S_{pooled} = W / (n - 2)$  instead of  $W$ , but the allocation rule is the same. Since  $W$  is symmetrical, write

$$\boldsymbol{\gamma} = W^{-1} \boldsymbol{\delta}; \tag{3.2}$$

then Fisher's discriminant function simplifies to

$$f(\mathbf{x}) = \boldsymbol{\gamma}^T (\mathbf{x} - \mathbf{x}_{av}).$$

**c. Multiple Regression**

Let  $\mathbf{y} = \begin{pmatrix} +\mathbf{1}_{n_1 \times 1} \\ -\mathbf{1}_{n_2 \times 1} \end{pmatrix}$  denote a response vector of length  $n$ , and consider a regression of  $\mathbf{y}$  on  $X$ . Then, the ordinary least squares regression function can be written as

$$g(\mathbf{x}) = \hat{\alpha} + \hat{\boldsymbol{\beta}}^T \mathbf{x},$$

where  $\hat{\alpha} = \bar{y} - \hat{\boldsymbol{\beta}}^T \bar{\mathbf{x}}$ , and  $\hat{\boldsymbol{\beta}} = (X^T HX)^{-1} X^T H\mathbf{y} = T^{-1} X^T (H\mathbf{y})$ . Note that  $\hat{\boldsymbol{\beta}}$  is estimated using the centered data matrix  $HX$ , we then claim that

$$\hat{\boldsymbol{\beta}} \propto \boldsymbol{\gamma}, \tag{3.3}$$

where  $\boldsymbol{\gamma}$  is as defined in(3.2).

**d. Proof**

First note that the centered vector  $H\mathbf{y}$  has entries  $+1 - \bar{y}$  in the first  $n_1$  places and  $-1 - \bar{y}$  in the final  $n_2$  places. Since  $\bar{y} = (n_1 - n_2) / n$ ,  $H\mathbf{y}$  simplifies to  $2n_1 n_2 / n$  times a vector with  $+1 / n_1$  in the first  $n_1$  places and  $-1 / n_2$  in the final  $n_2$  places. Hence,

$$\begin{aligned} X^T (H\mathbf{y}) &= (1 / n_1) X_1^T \mathbf{1}_{n_1} - (1 / n_2) X_2^T \mathbf{1}_{n_2} \\ &= \bar{\mathbf{x}}_1 - \bar{\mathbf{x}}_2 = \boldsymbol{\delta}, \end{aligned}$$

where  $\boldsymbol{\delta}$  is as defined in(3.1).

Showing that  $\hat{\boldsymbol{\beta}} \propto \boldsymbol{\gamma}$  is equivalent to showing that  $T^{-1} \boldsymbol{\delta} \propto \boldsymbol{\gamma}$ , which is true if and only if

$$\begin{aligned} \boldsymbol{\delta} &\propto T\boldsymbol{\gamma} \\ &\propto TW^{-1} \boldsymbol{\delta} \\ &\propto (W + B)W^{-1} \boldsymbol{\delta} \\ &\propto (I + (n_1 n_2 / n) \boldsymbol{\delta} \boldsymbol{\delta}^T W^{-1}) \boldsymbol{\delta} \\ &\propto \boldsymbol{\delta} + (n_1 n_2 / n) \boldsymbol{\delta} (\boldsymbol{\delta}^T W^{-1} \boldsymbol{\delta}) \\ &= \{1 + (n_1 n_2 / n) (\boldsymbol{\delta}^T W^{-1} \boldsymbol{\delta})\} \boldsymbol{\delta} \\ &= u \boldsymbol{\delta}, \end{aligned}$$

where  $u = \{1 + (n_1 n_2 / n) (\boldsymbol{\delta}^T W^{-1} \boldsymbol{\delta})\}$  is a constant. Hence, the result is proved.

**e. Regression rule**

Set,

$$\begin{aligned}
 g(\mathbf{x}) &= \hat{\alpha} + \hat{\boldsymbol{\beta}}^T \mathbf{x} \\
 &= \bar{y} - \hat{\boldsymbol{\beta}}^T \bar{\mathbf{x}} + \hat{\boldsymbol{\beta}}^T \mathbf{x} \\
 &= \bar{y} + \hat{\boldsymbol{\beta}}^T (\mathbf{x} - \bar{\mathbf{x}}),
 \end{aligned} \tag{3.4}$$

and allocate to  $\Pi_1$  if  $g(\mathbf{x}) \geq 0$ , otherwise to  $\Pi_2$ . If on the other hand, we set  $\mathbf{x} = \mathbf{x}_{av}$ , then,

$$g(\mathbf{x}_{av}) = \bar{y} + \hat{\boldsymbol{\beta}}^T (\mathbf{x}_{av} - \bar{\mathbf{x}}) \neq 0,$$

unless  $n_1 = n_2$ . Hence, the naive regression is different from Fisher's rule. We have used the term naive regression to explain that the function  $g$ , specified in(3.4) is identical to FDA if and only if  $n_1 = n_2$ .

#### f. Alternative rule

Alternatively, we can shift the regression predictor by a constant value to

$$\begin{aligned}
 g^*(\mathbf{x}) &= g(\mathbf{x}) - (\hat{\alpha} + \hat{\boldsymbol{\beta}}^T \mathbf{x}_{av}) \\
 &= \hat{\alpha} + \hat{\boldsymbol{\beta}}^T \mathbf{x} - \hat{\alpha} - \hat{\boldsymbol{\beta}}^T \mathbf{x}_{av} \\
 &= \hat{\boldsymbol{\beta}}^T (\mathbf{x} - \mathbf{x}_{av}),
 \end{aligned} \tag{3.5}$$

and define another rule: allocate  $\mathbf{x}$  to  $\Pi_1$  if  $g^*(\mathbf{x}) \geq 0$  and to  $\Pi_2$  otherwise. The allocation rule given by  $f$  and  $g^*$  are identical, hence we call  $g^*$  a regression based discriminant function instead of  $g$ . In summary, the Fisher's allocation rule based on  $f$  is identical to the regression-based allocation rule based on  $g^*$ .

### IV. EMPIRICAL INVESTIGATION

This investigation will involve the use of some real world and simulated datasets to investigate the identical relationship of FDA and RDA as proved in section III. The majority of the datasets used were sourced from the UCI Machine Learning Repository [11], and KEEL dataset repository [12]. We preprocessed all the datasets to ensure that each class label is identified with the name "class", and consists of a vector of +1 and -1 discrete variables. This way, we avoid the problem of rewriting the program we used each time a different dataset is involved. The datasets include:

#### Australia Dataset

The Australia dataset concerns credit card applications, and all attribute names and values have been changed to meaningless symbols to protect confidentiality of the data. It has dimensions \$ 690 \times 14 \$, with two classes representing approved and not approved. The data source is [12], and website; <http://sci2s.ugr.es/keel/dataset.php?cod=53>.

#### Handheight

The Handheight dataset is two dimensional, and consists of heights and stretched hand span of 167 male and female college students. Each student decided which of their hands to measure. Class +1 has 89 samples whereas class -1 consists of 78 samples. The source of the data is [13].

#### Heart

This is a real world binary classification heart disease dataset, and the task is to detect the absence (-1) or presence (1) of heart disease. It contains 270 samples and 13 features, with 120 samples in class +1 and 150 samples in class -1. The data was sourced from the UCI Machine Learning Repository.

#### Ionosphere

Ionosphere is a radar dataset collected by a system in Goose Bay, Labrador. The system consists of a phased array of 16 high-frequency antennas with a total transmitted power of the order of 6.4 kilowatts. The targets were free electrons in the ionosphere. "Good" radar returns are those showing evidence of some type of structure in the ionosphere. "Bad" returns are those that do not; their signals pass through the ionosphere.

Received signals were processed using an autocorrelation function whose arguments are the time of a pulse and the pulse number. There were \$ 17 \$ pulse numbers for the Goose Bay system. Instances in this database are described by 2 attributes per pulse number, corresponding to the complex values returned by the function resulting from the complex electromagnetic signal. The dataset is included in the mlbench package [14].

**Mammographic**

This dataset was used to predict the severity (benign or malignant) of a mammographic mass lesion from BI-RADS attributes and the patient's age. It contains a BI-RADS assessment, the patient's age and three BI-RADS attributes together with the ground truth (the severity field, which is the target attribute). The dataset was collected at the Institute of Radiology of the University Erlangen-Nuremberg between 2003 and 2006. It has dimensions  $830 \times 5$ , and the source is the KEEL dataset repository.

**Twonorm**

This dataset is 20 dimensional, and consists of 2 classes. Each class is drawn from a multivariate normal distribution. Class +1 has mean  $(a, a, \dots, a)$  while Class -1 has mean  $(-a, -a, \dots, -a)$ ;  $a = 2 / \text{sqrt}(20)$ . The dataset has dimensions  $7400 \times 20$ , and is contained in the KEEL dataset repository.

**Wisconsin Diagnostic Breast Cancer (WDBC) Dataset**

WDBC is a real-world dataset, and contains 30 features computed from a digitized image of a fine needle aspirate (FNA) of a breast mass. They describe characteristics of the cell nuclei present in the image. The number of instances is 569 and the task is to determine if a tumor found is benign or malignant ( $-1 = \text{malignant}$ , and  $1 = \text{benign}$ ). It was sourced from the UCI Machine Learning Repository.

V. DISCUSSION

Contained in Table 1 are the error rates of FDA and RDA on seven different datasets. Based on the differences in the two error rates, it seems that the two classifiers are identical. In two of the datasets, namely Handheight and Twonorm, we observed small positive differences between the two classifiers. Given the datasets, the error rates of RDA appear to be marginally smaller than the error rates of FDA. Regarding the dataset WDBC, we observed a small negative difference of  $-0.0175$ . It shows that on this dataset, the error rate of FDA is marginally smaller than the error rates of RDA. The two classifiers have the same error rates on four different datasets, namely Australia, Heart, Ionosphere and Mammographic datasets.

S/nos	Dataset Name	FDA Error Rate	RDA Error Rate	Diff
1	Australia	0.1353	0.1353	0.0000
2	Handheight	0.1800	0.1200	0.0600
3	Heart	0.1489	0.1489	0.0000
4	Ionosphere	0.1810	0.1810	0.0000
5	Mammographic	0.2088	0.2088	0.0000
6	Twonorm	0.0216	0.0212	0.0004
7	WDBC	0.0234	0.0409	-0.0175

Table 1: Error rates of FDA and RDA on seven different datasets

An intuitive appeal from Table 1 is that observed differences in error rates are non-significant. Nevertheless, at a p-value of 0.7893, a non-parametric Wilcoxon signed rank test [15] failed to reject the hypothesis that observed differences in the two error rates are non-significant at 5% level of significance. This development is further confirmation that both classifiers are identical.

VI. SUMMARY/CONCLUSIONS

The main argument presented by [9] is that  $\mathbf{w} = \text{inv}(S_w)(\mathbf{m}_1 - \mathbf{m}_2)$  is identical to the Fisher's Linear Discriminant vector of coefficients. We equally observed that the same is true concerning  $\hat{\beta}$ , because in section III we proved that  $\hat{\beta} \propto \gamma$ .

The outcome of empirical investigations contained in Table 1, suggests lack of evidence for significant differences in the error rates of the two classifiers. A further test of hypothesis based on the Wilcoxon signed rank test failed to reject the hypothesis that differences in the error rates of the classifiers are non-significant. Thus far, it is our conclusion that the two classifiers are identical. Hence, a choice of either FDA or RDA for a given binary classification problem is appropriate, and therefore recommended.

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# Breast Cancer and its Associated Factors among Women Visiting Oncology & Surgery OPD and Ward of JHL

Zaria Rahim

**Abstract- Background:** Breast Cancer is a commonest malignancy and is the second most cause of cancer related deaths among female. The knowledge of its risk and protective factors is important to the adoption of primary prevention strategies. Occurrence of breast cancer is related to genetic as well as cultural, environmental and life-style factors. Variations in diversity of these factors among different ethnic groups and geographical areas emphasize the immense need for studies in all racial-ethnic populations. **Objective:** To study the risk factors for breast cancer among female visiting Surgery and Oncology OPD and ward of Jinnah Hospital Lahore. **Materials and Methods:** A cross sectional study was conducted at the tertiary care hospital, Jinnah Hospital Lahore, with a sample size of 200. Sampling technique was non-probability purposive sampling. **Results:** Among the females having Breast Cancer, the use of contraception was 26% with the p-value = 0.00 which was significant. Mothers who did not breast feed their children were 24% with p – value =0.00 which was also found to be significant. Females with positive family history of Breast Cancer was 34% with the p-value=0.00 which was statistically significant. **Conclusion:** Positive Family history and use of Oral contraceptives are the significant Risk factors of Breast Cancer while being Multiparous and promoting Breast feeding reduces the possibility of Breast Cancer.

**Index Terms-** Breast Cancer. Contraception. Family History

## I. INTRODUCTION

Breast cancer is a hormonally mediated disease caused by repeated exposure of breast cells to circulating hormone. Breast Cancer is the commonest malignancy and second most cause of cancer related deaths among females comprising of 18% of all female cancers.<sup>1</sup> Number of breast cancers is rising each day and approximately 1 million new cases appear in world each year.<sup>2</sup> Every 3 min a woman is being diagnosed with breast cancer.<sup>3</sup> According to World Cancer Report incidence would go up by 50% to 1.5 million by year 2020.<sup>1</sup>

Chronic stressful life events in women were associated with an increased incidence of breast cancer due to stress-induced inhibition of estrogen synthesis.<sup>5</sup> Breast cancer appeared to be higher in women with increasing age, early menarche (<12 yr), late menopause, first full term pregnancy (FFTP) after age of 30 yrs.<sup>2</sup> Breast Cancer also proved to be associated with family history of endometrial cancer and history of exogenous hormonal

intake.<sup>2</sup> Nulliparity and history of never having breast fed proved to be a risk factor of breast cancer.<sup>6</sup>

Overweight postmenopausal women had 10-20% risk of breast cancer whereas obese postmenopausal women had 30% risk of breast cancer.<sup>3</sup> Increased BMI proved to be a protective factor before menopause but detrimental after menopause, but still reports on this are inconclusive.<sup>7</sup> Nutrition also played a role as a risk factor in early life.<sup>8</sup> Similarly those women who used Oral contraceptives specifically before first full term pregnancy is at an increased risk of developing Breast Cancer.<sup>9</sup>

Socioeconomic status and life style changes and menstrual pattern changes are found to be responsible for a rise in breast cancer in developing countries. Moreover, increased life Expectancy had increased the burden of breast cancer.<sup>10</sup>

There seems a geographical variation in incidence and mortality rates of Breast Cancer suggesting that risk factor for breast cancer vary in different parts of the world.<sup>3</sup>

Therefore, objective of this study was to determine the prevalent risk factors in our society contributing to a mass increase in Breast Cancer in our society.

## II. METHODOLOGY

A cross sectional study was conducted at Oncology and Surgery OPD and wards of Jinnah Hospital Lahore, a 1500 bedded tertiary Care hospital located at Shabbir Usmani Road. Sample of 200 patients was taken through non probability purposive sampling. Duration of study was 3 months. Inclusion criteria was all married women, women diagnosed as having Breast cancer and women visiting for follow ups after successful treatment. Exclusion criteria included patients with terminal stage Breast cancer, patients having breast lump with no biopsy report and non-compliant breast cancer patients. Data was collected on a structured questionnaire after approval of ethical committee and informed consent of the departments. Data was analyzed by using computer software SPSS (statistical Package for social sciences) version 17.00. Frequency tables were generated for dependent and independent variables. Chi square test for qualitative variables and t-test for Quantitative variables was applied to see the level of significance of relation between various variables.

## III. RESULTS

### **Table 1: USE OF CONTRACEPTIVES BY THE RESPONDENTS**

Contraceptives Use	Frequency	Percent
No	148	74.0
Yes	52	26.0
Total	200	100.0

**Table 2: RESPONDENTS HAVING FAMILY HISTORY OF BREAST CANCER**

Family history	Frequency	Percent
No	132	66.0
Yes	68	34.0
Total	200	100.0

#### IV. RESULTS

Mean age of diagnosis was 46.14 of patients suffering from the diagnosis of Breast Cancer. About 98 (49%) patients having Breast Cancer were those married at an early age of 15-20 yrs. About 37 (18.5%) patients were Nulliparous who had Breast Cancer. The use of Hormone replacement therapy and contraceptives among Breast Cancer patients was 45 (22.5%) and 52 (26%) respectively. (Table 1). A positive Family History of Breast Cancer was seen in 68 (34%) cases (Table 2). Among those married, 38 (19%) had first full term pregnancy at age of 26-35 yrs. About 48 (24%) did not breast feed their children thus eliminating the protective factor. Breast Cancer was found more prevalent in child bearing and post menopausal women with 73 (36.5%) and 53 (26.5%) cases respectively. About 43.5% (87) were overweight with a BMI of 24.9- 29.9.

The results showed that Breast Cancer was more prevalent in low socioeconomic group with 108 (54%) patients having an Income/capita of 500- 5000 Rs. The results showed that 67 (33.5%) of females had an early age of menarche ( $\leq 12$  yrs)

Multiple Response table for risk factors revealed 33.5 % of cases had an early age of menarche with  $p$ -value=0.00 which was statistically significant. Nulliparity was seen in 18.5% of cases with the  $p$ -value = 0.000 so was significantly associated in causing Breast cancer. No breast feeding was seen in 48 (24%) of cases with the  $p$  value = 0.000 which is statistically significant. Family history of Breast Cancer was seen in 68 (34%) of cases with the  $p$ -value = 0.000 which is statistically significant. Use of contraceptives was seen in 52 (26 %) of case with the  $p$ -value = 0.000 which is statistically significant.

#### V. DISCUSSION

Breast Cancer incidence rates are increasing worldwide. The continuing rise in Breast Cancer incidence has created an urgent need to develop strategies for its factor.

Age is an important risk factor. Breast Cancer risk increases as age advances. In our study mean age of Breast Cancer patients were 46.6. Average age of cases in a study at India was 49.9.<sup>3</sup> Early age of menarche ( $\leq 12$  yrs) was found to be in 67 (33.5%) of females which did not match with the results of another case control study at Tertiary Care Hospital Karachi with early age of menarche( $\leq 12$  yrs) found in 25 (8.7%) of female cases only.<sup>11</sup>

Breast Cancer was found in 37 (18.5%) nulliparous females in our study. In study at Fatima Jinnah College showed that 14 (7%) patients were nulliparous.<sup>12</sup>

About 48 (24%) did not Breast feed their children and among 76% who breast fed, 60 (30%) were those who breast fed for less than 2 yrs. In another study conducted at China women who did not breast fed were 43 (22%).<sup>13</sup>

In our study Breast Cancer was more prevalent in Child bearing age with 73 (36.5%) of female cases. In contrast a study conducted by Ghausia Masood at Punjab University 188 (42%) cases of Breast Cancer were found to be premenopausal women.<sup>7</sup>

Family History of Breast Cancer among first degree relatives was seen in 68 (34%) of cases. A study published in Asian Pacific Journal of Cancer, family history was positive in 59 (10.1%) cases of Breast Cancer.<sup>11</sup>

In our of use study the use of hormone replacement therapy and Oral Contraceptives pills among Breast Cancer patients was 45 (22%) and 52 (26%) respectively. Whereas in a study at Iran, Oral Contraceptives use was 61.1% in Breast

Cancer patients and HRT use was 28.6%.<sup>3</sup> Our results showed that Breast Cancer is prevalent more in low socioeconomic group with results as 108 (54%) cases. The study done at Punjab University showed that 858 (63.8%) cases belonged to low socioeconomic group.<sup>5</sup>

## VI. CONCLUSION

The findings of the present study suggests that positive family history of breast cancer and history of using OCP may be the epigenetic factors promoting the occurrence of breast cancer while breastfeeding and multiparity reduces the possibility of acquiring breast cancer. The study confirmed a few of the recognized risk factors among Pakistani women so we should promote breast feeding and should raise breast cancer awareness among Pakistani Women.

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# Potential drug target proteins involved in liver stage of malarial parasite and various approaches of their expression as recombinant protein

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**Abstract-** Malaria parasite proteins like circumsporozoite protein (a surface protein), are expressed during liver stage of plasmodium parasite life cycle and are involved in host modulation and the virulence. These proteins could serve as good candidate for the drug development against malaria parasite. Malaria parasite traffic its virulence proteins into the hepatocyte cytosol for its development in hepatocyte. These parasite proteins modify the hepatocyte cytosol for maximum benefit of parasite. This process changes the permeability of the hepatocyte for uptake of various nutrients and factors required for parasite survival in hepatocyte. Trafficking of parasite proteins into hepatocytes depends on a conserved pentameric motif, known as PEXEL-motif. Marti et al. identified 22 sporozoite stage proteins in *P. falciparum* that had putative PEXEL motif. It has been identified that protein that contains PEXEL motif can be a potential drug candidate.

**Index Terms-** circumsporozoite protein, liver stage, Malaria, PEXEL motif.

## I. INTRODUCTION

Malaria is an infectious disease caused by protozoan intracellular obligate parasite, wide spread in tropical and subtropical regions which extensively modify and remodel the host cell for their own need. According to the center for disease control and prevention, it has been reported that each year 300-500 million people are infected by the malaria parasite and results in 3-5 million people death (1). Malaria parasite Plasmodium, belongs to the phylum Apicomplexa that include other important intra-cellular pathogen such as Toxoplasma, Babesia, Theileria, Eimeria and Cryptosporidium which is characterized by presence of chloroplast like Apicoplast, An apical polar ring which serve as microtubule organizingcentre and secretory vesicles named as roptries and microneme. Both the organelles, roptries and microneme are released at the anterior tip of the parasite and their content are involved in apicomplexan motility, host cell invasion and generation of non-phagosomalparasitophorus vacuole where the parasite reside and replicate inside host cell. Malaria belongs to the poverty and is hindrance in economic development of the country

In the mammalian host, invasion of the hepatocytes is the first step towards developing malaria disease. Invasion by infective sporozoites is complex process and not understood very well. During early liver stage development a sporozoite surface protein (CSP) is introduced in the hepatocytes cytoplasm. CSP then shuttles into and out of nucleus of hepatocytes and changes the host transcription profile. CSP export into the cytoplasm of infected hepatocyte requires the presence of PEXEL / HTS motifs. The transport of CSP into the hepatocyte nucleus is then mediated by importins  $\alpha 3/\beta 1$  that binds to the nuclear localization signal (NLS) of CSP. The NLSs of CSP and NF $\kappa$ B p50 share the same importins. The entry of NF $\kappa$ B-p50 into the nucleus is strongly inhibited in cell lines expressing CSP, and in infected hepatocytes. Microarray data, from a N-terminal truncated CSP expressing cell line, showed that 40 NF $\kappa$ B targets were significantly down regulated. Presence of CSP in the host modifies thousands of host gene transcription that govern diverse biological processes such as

metabolite transport, cell cycle, immune responses, cell growth, cell attachment, apoptosis and hypoxia and the overall effect is to enhance EEF growth.

## II. THE LIFE CYCLE OF MALARIA PARASITE

It is very complicated and is completed in two hosts. The one is human and other vertebrates, which act as intermediate host for the malaria parasite where asexual part of life cycle occur and other one is mosquitoes, where sexual part of life cycle take place and act as definitive host for the parasite. Malaria in humans is caused by four species of Plasmodium (2).

1. Plasmodium vivax - benign malaria, incubation period 12-20 days
2. Plasmodium falciparum - malignant malaria, incubation period 8-15 days
3. Plasmodium malariae- benign malaria, incubation period 18-40 days
4. Plasmodium ovale- benign malaria, incubation period 11-16 days

Plasmodium berghei and Plasmodium yoelii are mouse malaria parasites. Among four human malaria species, P. falciparum, one of the deadliest parasites, causes severe disease in humans resulting in more than million deaths per year. Malignant malaria can kill but other forms are less likely to prove fatal.

### Life cycle

The complete life cycle of the malaria parasite is completed in three stages:

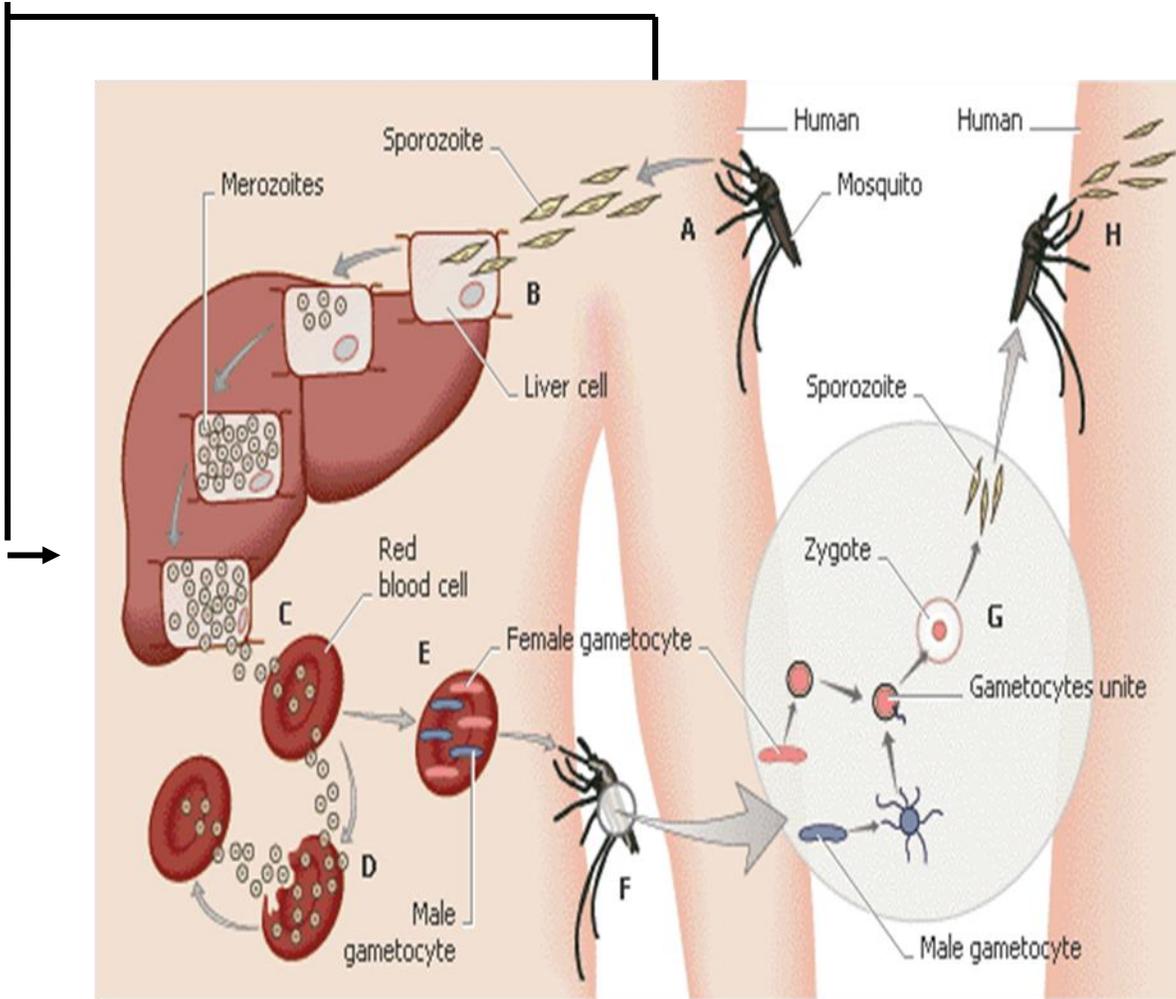
- 1) Sporogonic cycle take place in mosquito.
- 2) Exo-erythrocytic cycle take place in the Liver of infected person.
- 3) Erythrocytic cycle take place in the erythrocyte of infected person.

Malaria infection starts when the mosquito takes their blood meal (3) and injects the sporozoite into the host skin. The sporozoite enters into blood stream, reach to the Liver where they invade the hepatocytes and developed into Exo-erythrocytic form (EEF). EEF grow and differentiate into thousands of merozoites which are released by rupturing of the hepatocyte and invade the RBC to continue the Erythrocytic cycle and cause the symptoms of the disease. Some merozoites developed into gametocyte, which are taken up by mosquito during their blood meal. Inside the mosquito, gametocyte fused to form the zygote which further developed into invasive ookinetes. Ookinetes reach to the space between midgut epithelium and basal lamina of mosquito where they develop into oocysts. Thousands of sporozoites developed in oocyst and released into the hemolymph. They invade salivary gland and remain viable but do not replicate.

### Plasmodium Virulence Proteins

When the sporozoites invade the hepatocytes, they hide themselves in a specialized vacuolar compartment called parasitophorous vacuole (4). The membrane of this vacuole is derived from host cell plasma membrane and physically separates the parasite from host cell. Further development of parasite take place inside this parasitophorous vacuole. Malaria parasites export hundreds of proteins to remodel the host cell in order to get access to nutrients, solute, ions and other things required for the parasite survival and its propagation inside the host cell (5)

### Pre-erythrocytic stage



### Erythrocytic stage

### Mosquito stage

Figure-1. Life cycle of malarial parasites.

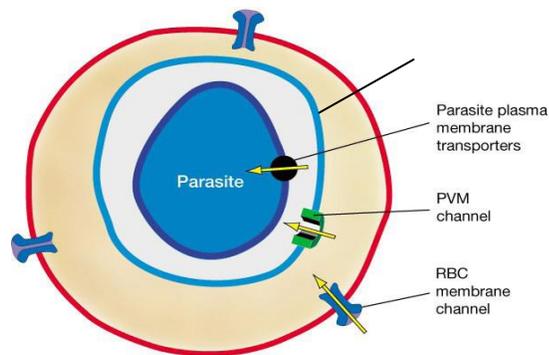


Figure-2. Infected erythrocyte

Parasite exported protein have to cross the two barriers in order to reach the host cytosol. These two barriers are parasite plasma membrane and PV-membrane (6). The parasite protein crosses the plasma membrane by vesicular transport (7) and reach to the space between PVM and parasite. In the infected RBCs, export of these parasite proteins into host cell depend on plasmodium export element (pexel) or vacuolar transport signal (VTS) (8).

Marti et al. found that virulence proteins of infected RBCs have a trafficking signal. The first part of the signal is SS; responsible of export into the PV and second is a motif that targets the protein for onward transport into the erythrocyte proper. Marti et al. termed that motif as PEXEL (Plasmodium Export element) motif. It is also known as VTS (Vacuolar Transport Signal) or HT (Host Targeting) signal. Marti et al. also found the following features of the conserved pentameric motif –

- (1) Positively charged hydrophilic amino acid in position 1, (Arg and Lys).
- (2) A hydrophobic amino acid in position 3 (mainly Leu)
- (3) Less conserved amino acid in position 5 (predominantly Asp, Glu and Gln).
- (4) Non charged any amino acid in position 2 and 4

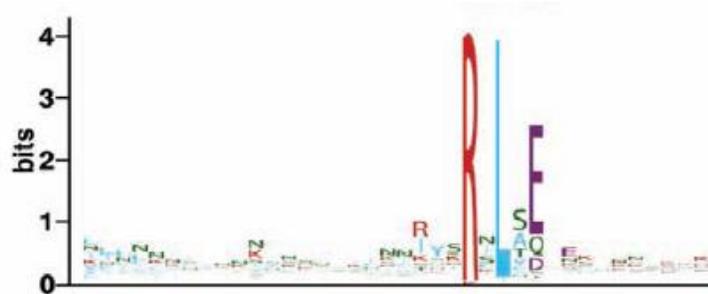


Figure 3. Pexel motif in Plasmodium erythrocytic stage [Consensus: (R/K) X (L) X (E/D/Q)].

The presence of PEXEL containing protein also in hepatocytic stages, indicates that the machinery for protein translocation across the PV membrane is common in different host cell type. Plasmodium sporozoites have surface protein, known as circumsporozoite (CS) protein. CS is also present in the plasma membrane of EEFs (Exoerythrocyte form) and has been detected in the cytoplasm of the infected hepatocytes. Previous reports suggest that CS plays central role in several stages of parasite life cycle. It is useful for sporozoite development in the oocysts, Invasion of hepatocytes and for EEF development (9). It is a master regulator of plasmodium pre-erythrocytic stages development.

CS has the PEXEL motif by which it traverses the PV membrane. CS protein also has a NLS (Nuclear Localization Signal) and a putative NES (Nuclear export signal) at C-terminus (9). NLS in CS uses alpha3 importin to enter into the nucleus. Binding of CS to importin alpha3 was abolished after deletion of the NLS. It has been proved that NLS has a role in the enhancement of EEF development. Hence plasmodium has PEXEL motif, to introduce the CS protein into the hepatocyte cytoplasm and a NLS to enter its nucleus. Once inside hepatocyte cytoplasm, CS out competes NFkB (involved in inflammation) nuclear import, thus down regulating the expression of many genes; controlled by NFkB. Thus CS inside hepatocyte creates a favorable niche for parasite growth. CS currently is a target antigen for vaccine against liver stage of malaria and it is in a phase-II clinical trials and have shown partial protection (~50%).

## Liver stage of Malaria Parasite

Liver stage of the malaria parasite is asymptomatic, considered the most promising target for vaccine and good target for prophylactic drugs because the parasite number is limited and intervention at this stage prevent the progression of disease to blood stage (10). The long lasting protection against the malaria is achievable with radiated or genetically attenuated sporozoite which cannot complete liver stage development and thus disease does not progress to symptomatic blood stage (11). The one licensed drug against LS is primaquine though it is contraindicated in pregnant women and individuals with Glucose-6phosphate deficiency, but primaquine can kill the *P.vivax* hypnozoites in liver (12). A comprehensive liver stage gene expression analysis shows that approximately 2000-genes are expressed at this stage which aids in liver stage development of which 66% have orthologs in *P. falciparum*. Gene expression profile of LS and intraerythrocyte stages are more similar than the mosquito stage sporozoite (13). The proteome analysis of liver stage shows that approximately 712 proteins are expressed at this stage of which 90% have orthologs in *P.falciparum*. Liver stage is the best stage for the prevention of malarial parasite because in this stage parasitic load is small (under 500).

Marti et al. identified 22 sporozoite stage proteins in *P. falciparum* that had putative PEXEL motif. Many of these proteins are hypothetical and their function or localizations are not known. These proteins most likely function only after invasion of hepatocyte and PV formation.

### III. EXPRESSION OF RECOMBINANT PROTEIN

Too little is known about the mechanism of folding of proteins in different organisms to predict which host – vector system might be best for given protein, and few methods are available to increase the efficiency of folding or to prevent the aggregation, denaturation, and/or degradation of foreign proteins expressed in the environments that are unnatural to them (14).

Five major expression systems have been developed to a point where they are reasonably portable from one laboratory to another. The host cells for these systems are *E. coli*, *Bacillus subtilis*, *Saccharomyces cerevisiae*, cultured insect cells, and cultured mammalian cells.

Because of the vast knowledge about its genetics, biochemistry, and molecular biology, *E. coli* is the system of first choice for expression of many heterologous proteins. Genetic manipulations are straightforward, cultures of *E. coli* are easily and inexpensively grown, and many foreign proteins are well tolerated and may be expressed at high level (15).

#### Choosing an expression system

Factors that influence the choice of a system for expression of a particular protein in *E. coli* are listed below.

- The size of the protein. Small cytosolic proteins and polypeptide (< 100 residues in length) are best expressed in *E. coli* as fusion proteins composed of carrier sequences linked by a standard peptide bond to the target protein. Cytosolic proteins >100 residues in length are the most problematic proteins to express in either system. In *E. coli*, these proteins are often unstable or form insoluble inclusion bodies.
- The amount of protein needed. If only small quantities of target protein are required- for example, when screening a series of site-directed mutants for enzymatic activity- there is little point in trying to optimize production.
- Whether active protein is required. If the purpose of expressing the target protein is simply to obtain material for raising antibodies, there is no point in trying to obtain active protein. Instead, expression system can be used that facilitate purification of target protein, irrespective of its state of biological activity or denaturation.

#### Choosing a promoter and vector system

The following categories of expression vectors are described on basis of the type of promoter.

- Expression Vectors containing an IPTG-inducible Promoter. Several different vectors based on the lac operon are used for high – level expression of foreign proteins in *E. coli*, including: the trp-lac (tac) promoter (16), the trp-lac promoter (17), the lac promoter (18).
- Expression vectors containing the bacteriophage T7 promoter. The pET series of vectors, originally developed by Studier et al. (1990) and since expanded, allow regulated expression of foreign genes by bacteriophage T7 RNA polymerase.
- Expression vectors containing bacteriophage  $\lambda$  pL promoter. In vectors of this class, the bacteriophage  $\lambda$  pL promoter is regulated by a temperature sensitive repressor, cIts857, which represses pL- driven transcription at low temperature but not at elevated temperature.

## Cloning & Expression

### The vector

GST fusion proteins are constructed by inserting a gene or gene fragment into the multiple cloning sites of pGEX vectors. Expression is under the control of the tac promoter, which is induced by the lactose analog, isopropyl b-D thiogalactoside (IPTG). All pGEX vectors are also engineered with an internal lacIq gene. The lacIq gene product is a repressor protein that binds to the operator region of the tac promoter, preventing expression until induction by IPTG, thus maintaining tight control over expression of the insert.

### The Host

Although a wide variety of *E. coli* host strains can be used for cloning and expression with the pGEX vectors, there are specially engineered strains that are more suitable and that may maximize expression of full-length fusion proteins. Strains deficient in known cytoplasmic protease gene products, such as Lon, OmpT, DegP or HtpR, may aid in the expression of fusion proteins by minimizing the effects of proteolytic degradation by the host (19-22). Using *E. coli* strains that are not protease-deficient may result in proteolysis of the fusion protein, seen as multiple bands on polyacrylamide gels (SDS-PAGE) or Western blots. *E. coli* BL21, a strain defective in OmpT and Lon protease production, has been specifically selected to give high levels of expression of GST fusion proteins. An alternative strain for cloning and maintenance of the vector (e.g. JM105) should be used, as BL21 does not transform well. However, one should not use an *E. coli* strain carrying the recA1 allele for propagation of pGEX plasmids. There have been reports that these strains can cause rearrangements or deletions within plasmid DNA.

### Insert DNA

Insert DNA must possess an open reading frame. Whether subcloned from another vector or amplified by PCR, the insert must have ends that are compatible with the linearized vector ends. Using two different restriction enzymes will allow for directional cloning of the insert into the vector. Directional cloning will optimize for inserts in the correct orientation.

### Expression

Expression in *E. coli* yields fusion proteins with the GST moiety at the amino terminus and the protein of interest at the carboxyl terminus. The protein accumulates within the cell's cytoplasm. GST occurs naturally as a 26000Da protein that can be expressed in *E. coli* with full enzymatic activity. After clones expressing the fusion protein have been selected, growth conditions should be evaluated for optimal expression. Media, growth temperature, culture density, induction conditions and other variables should

be evaluated. The presence of inclusion bodies may affect optimization of expression. High-level expression of foreign fusion proteins in *E. coli* often results in formation of inclusion bodies. Inclusion bodies comprise dense, insoluble aggregates that are failed folding intermediates (23-24).

Formation of inclusion bodies can be advantageous in purifying an active form of an expressed fusion protein that otherwise may be unstable in the soluble fraction. However, the steps needed to solubilize and refold the fusion protein can be highly variable and may not always result in high yields of active protein. A variety of growth parameters can be investigated for good expression, either solely or in combination, that may provide a good yield of non-degraded fusion protein in the soluble fraction. Steps to investigate include:

- Lowering the growth temperature to between 20 °C and 30 °C
- Increasing aeration
- Altering induction conditions.

In general, induction at lower cell densities ( $A_{600} = 0.5$ ) usually results in greater yields of the fusion protein in a soluble form. However, in some cases it may be beneficial to grow the cells to a higher cell density ( $> 1 A_{600}$  unit) for a shorter period of time, or simply to induce for a shorter period of time. Growing the cells to a higher cell density and either omitting induction by IPTG or reducing the IPTG concentration to 0.1 mM leads to lower yields, but more of the fusion protein is likely to be obtained in an intact form.

#### **IV. PURIFICATION**

GST fusion proteins are purified from bacterial lysates by affinity chromatography using immobilized glutathione. GST fusion proteins are captured by the affinity medium, and impurities are removed by washing. Fusion proteins are eluted under mild, non-denaturing conditions using reduced glutathione. The purification process preserves protein antigenicity and function. Cleavage of the protein from GST can be achieved using a site-specific protease whose recognition sequence is located immediately upstream from the multiple cloning sites on the pGEX plasmids. Fusion proteins can be detected using colorimetric or immunological methods.

#### **V. CONCLUSION**

In malarial parasite life cycle, liver stage parasite proteins are also involved in virulens and with application of various approaches towards cloning and expression of these genes as recombinant proteins in suitable expression system, potential anti malarial drug can be targated by understanding host-parasite interactions during malaria liver stages development, identifying Plasmodium proteins that modulate the hepatocyte cellular functions, knockout of parasite genes, target identification for inhibitor design, Known and novel compounds assay (ex vivo and in vivo) to test inhibitor/ drug efficacy, Discovery of new antigens from liver-stage parasites and evaluation in animal models. A multi-disciplinary approach is the need to address above issues.

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# Liver stage Plasmodium Protein Pb122500 and Implication for Vaccine Design

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**Abstract-** In the mammalian host, invasion of the hepatocytes is the first step towards developing malaria disease. There are some signals which are exchanged between host and parasite. During early liver stage development, a sporozoite surface protein (CSP) is introduced in the hepatocytes cytoplasm. CSP then shuttles into and out of nucleus of hepatocytes and changes the host transcription profile. CSP export into the cytoplasm of infected hepatocyte requires the presence of a conserved pentameric motif-PEXEL (Plasmodium export elements) motifs. The CS protein out compete with the NF $\kappa$ B for nuclear import and down regulate the host genes regulated by NF $\kappa$ B which are involved in inflammation. These proteins could serve as good candidate for the drug development against malaria parasite. Marti et al. identified 22 sporozoite stage proteins in *P. falciparum* that had putative PEXEL motif. It has been identified that protein Pb122500 also contains that PEXEL motif and has a putative serine–threonine kinase domain (so it is a drug candidate). The focus of current research is to study implications of Pb122500 gene as potential vaccine candidate by cloning and expressing the protein, characterizing the proteins, raise sera against them and try to localize these proteins in hepatocyte cells and find out further the host proteins interacting with these proteins so that we could find new antigen for vaccine against hepatic stages.

**Index Terms-** Cloning, Expression, Vaccine, SDS, Western, Vector, Pexel, Parasite, Liver.

## I. INTRODUCTION

According to the center for disease control and prevention, it has been reported that each year 300-500 million people are infected by the malaria parasite and results in 3-5 million people death (1,11). Malaria in humans is caused by four species of *Plasmodium* (2) *Plasmodium vivax*, *Plasmodium falciparum*, *Plasmodium malariae*, *Plasmodium ovale*. *Plasmodium berghei* and *Plasmodium yoelii* are mouse malaria parasites. The complete life cycle of the malaria parasite is completed in three stages: Sporogonic cycle, Exo-erythrocytic cycle, Erythrocytic cycle. When the sporozoites invade the hepatocytes, they hide themselves in a specialized vacuolar compartment called parasitophorous vacuole (4). The membrane of this vacuole is derived from host cell plasma membrane and physically separates the parasite from host cell. Further development of parasite take place inside this parasitophorous vacuole. Malaria parasites export hundreds of proteins to remodel the host cell in order to get access to nutrients, solute, ions and other things required for the parasite survival and its propagation inside the host cell (5). Parasite exported protein have to cross the two barriers in order to reach the host cytosol. These two barriers are parasite plasma membrane and PV-membrane (6). The parasite protein crosses the plasma membrane by vesicular transport (7) and reach to the space between PVM and parasite. In the infected RBCs, export of these parasite proteins into host cell depend on plasmodium export element (pexel) or vacuolar transport signal (VTS) (8). CS (Circumsporozoite) protein has the PEXEL motif by which it traverses the PV membrane. CS protein also has a NLS (Nuclear

Localization Signal) and a putative NES (Nuclear export signal) at C-terminus (9). NLS in CS uses alpha3 importin to enter into the nucleus. Binding of CS to importin alpha3 was abolished after deletion of the NLS. It has been proved that NLS has a role in the enhancement of EEF development. Hence plasmodium has PEXEL motif, to introduce the CS protein into the hepatocyte cytoplasm and a NLS to enter its nucleus. Once inside hepatocyte cytoplasm, CS out competes NFkB (involved in inflammation) nuclear import, thus down regulating the expression of many genes; controlled by NFkB. Thus CS inside hepatocyte creates a favorable niche for parasite growth. CS currently is a target antigen for vaccine against liver stage of malaria and it is in a phase-II clinical trials and have shown partial protection (~50%).

Marti et al. identified 22 sporozoite stage proteins in *P. falciparum* that had putative PEXEL motif. It has been identified that protein Pb122500 contains that PEXEL motif and has a putative serine-threonine kinase domain (so is a drug candidate). We searched for orthologues in rodent malaria parasite, as our model system of study is rodent malaria. Marti et al. found that virulence proteins of infected RBCs have a trafficking signal. The first part of the signal is SS; responsible of export into the PV and second is a motif that targets the protein for onward transport into the erythrocyte proper. Marti et al. termed that motif as PEXEL (Plasmodium Export element) motif. It is also known as VTS (Vacuolar Transport Signal) or HT (Host Targeting) signal. Marti et al. also found the following features of the conserved pentameric motif - Positively charged hydrophilic amino acid in position 1, (Arg and Lys). A hydrophobic amino acid in position 3 (mainly Leu). Less conserved amino acid in position 5 (predominantly Asp, Glu and Gln). Non charged any amino acid in position 2 and 4.

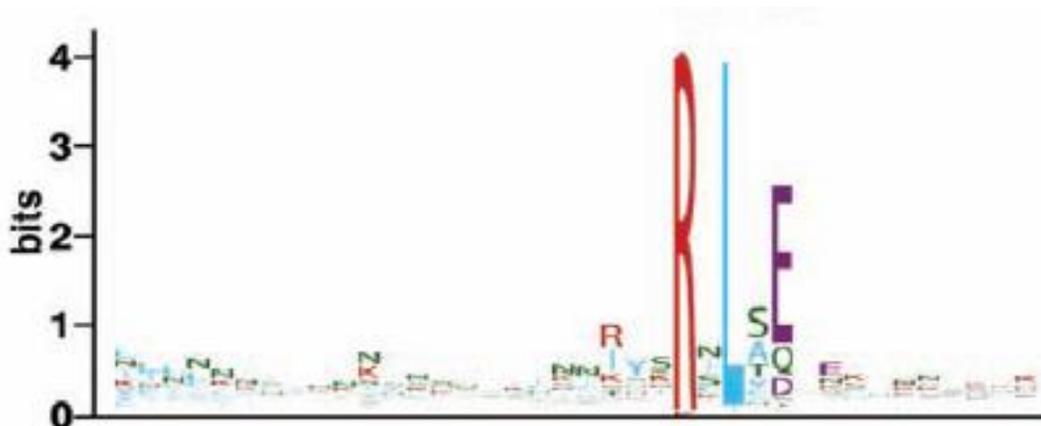


Figure 1: Pexel motif [Consensus: (R/K) X (L) X (E/D/Q)]

## II. MATERIALS & METHODSETHODS

### Materials

***E. coli* strains:** *E. coli* expression strain BL21, cloning strain DH5alfa and XL1-Blue has been used.

**Plasmids:** The *E. coli* expression vector pGEX6P1, pET28a, cloning vectors-TOPO vector, pUC19 has been used.

**Media and other materials:** Luria Bertani broth, LB Agar, Glycerol, from Hi media, nucleic acid extraction and purification kits from QAIGEN, Ampicillin, and Chloramphenicol were obtained from Sigma. Restriction Enzymes, buffers, were purchased from New England Bio-labs, USA. DNTPs, Taq polymerase HiFi DNA polymerase, Deep vent and their buffer were purchased from NEB.

## Methods:

***E. coli* culture and its preservation:** All the bacteria were grown in LB media at 37°C with shaking in the presence of appropriate antibiotic. The medium was sterilised by autoclaving at pressure of 15-lbs/square inch for 15 min. For preserving the bacterial cultures, cells were allowed to grow in LB media with appropriate antibiotic concentration, and when cells reach log phase, 300µl of the culture was added into the micro centrifuge tube containing 300µl of 50% glycerol solution. The cells were mixed thoroughly till the solution become homogenous and stored at -80°C.

**Expression check of Pb268 in PGEX-6p1:** *E. coli* strain BL21 was used for checking the expression of the recombinant protein Pb268 optimized (previous name of Pb122500). Pb268 optimized in PGEX in BL21 strain glycerol stock streaked on LB plates (AMP+CMP). 8 colonies streaked on another LB plate (AMP+CMP) and also inoculated in 10ml LB media each containing (AMP+CMP). The falcons were incubated at 37°C in a shaker incubator till OD<sub>600</sub> 0.6 was attained. IPTG was added to the culture at a final concentration of 1 mM. The cultures were incubated, for 12 hr at 37°C, prior to harvesting by centrifugation at 13000 rpm for 1.30 min at 4°C. The post induction cell pellet was resuspended in native lysis buffer (added Triton X-100, PMSF) at 2-5 ml per gm weight of the pellet. Lysozyme was added to 1 mg/ml and of cell pellet and incubated on ice for 30 min. The suspension was sonicated on ice (seven 3sec bursts with a 1sec cooling period between each burst) for 2-3 minutes for each of 8 samples at amplitude of 60. The lysate was centrifuged at 13000rpm for 2-3minutes at 4°C to pellet the cellular debris

**SDS PAGE for expression check:** Polyacrylamide gel electrophoresis under denaturing condition (in the presence of 0.1% SDS) was performed according to the method described by Laemmle (1970). The stacking gel containing 5 % acrylamide, 0.106% N, N'-methylene bisacrylamide, 0.1% SDS and 0.125 M Tris-HCl (pH 6.8) were mixed and polymerized. The separating gel had 12% or 15% acrylamide depending on the case and 0.1% SDS. Running buffer consisted of 0.025 M Tris-base, 0.192 M glycine, pH 8.3 containing 0.1% SDS. The protein samples were prepared in sample buffer [0.0625 M Tris-HCl, pH 6.8; 2% SDS, 10% glycerol, and 5% β-mercaptoethanol (Laemmli, 1970) and were denatured by boiling at 100°C for 10 min in lyses buffer. The electrophoresis was carried out at 30 mA. Wide dual range protein marker was run simultaneously to calculate the subunit molecular size of the proteins.

**Coomassie brilliant blue staining:** SDS-Polyacrylamide gels containing more than 200ng protein concentration were visualised by standard "Coomassie Brilliant Blue R 250 (CBB R 250)" staining solution {0.1% (w/v) CBB dissolved in 25% (v/v) methanol and 10% (v/v) acetic acid in water}, followed by de-staining in 25% (v/v) methanol and 10% (v/v) acetic acid in water.

**Western blot:** The proteins separated by SDS PAGE were transferred from the gel to nitrocellulose membrane with the help of semidry transfer system (Bio-Rad, USA). In brief, after removal of stacking gel, the resolving gel was soaked in transfer buffer for 5 min at 4°C. The nitrocellulose membrane and pieces of Whatman 3 mm filter papers were soaked in transfer buffer for 10 min at 4°C. The membrane was placed in the transfer apparatus after three layers of Whatman filter sheet. The gel was placed over the membrane followed by three layers of Whatman filter sheet. Care was taken avoid trapping any air bubble between the gel and

nirocellulosemembrane. The semidry transfer was carried out at 20 V for 30 min at room temperature. Following transfer, the membrane was carefully removed from the blotting apparatus and blocked with PBS containing 2% milk protein for 1 h at room temperature. The membrane was washed thrice with PBST and incubated with the primary antibody (anti -Flag) diluted 1: 3000 in PBS containing 0.5% milk protein of 1 h with constant rocking. The membrane was washed thrice with PBST and incubated with HRP-labeled anti mouse Ig antibody (diluted 1:4000 in PBS containing 0.5% milk protein) for 1 h. Following incubation, the membrane was washed five times with PBST and developed using DAB along with H<sub>2</sub>O<sub>2</sub> in PBS.

### III. RESULTS & DISCUSSIONS

#### Expression of C-terminal 490-510 amino acids of Pb 122500 (Previously Pb000268.02.0) in pGEX6p1 in RIL strain of *E.coli* at 370C with 1mM IPTG:

Pb000268.02.0 optimized in pGEX in RIL strain glycerol stock streaked on LB plates (AMP+CMF). Colonies were streaked on another LB plate (AMP+CMF) and also inoculated in LB media containing (AMP+CMF) and kept on shaker incubator on 370C. IPTG was added after OD600 0.6 was attained. The post induction cell pellet was resuspended in native lyses buffer. Lysozyme was added to cell pellet and incubated on ice. The suspension was sonicated. The lysate was centrifuged to pellet the cellular debris. 20µl of protein sample (each pellet and supernatant) with 5µl of 5X Protein Loading Dye and after giving heat treatmentwas loaded on 5% stacking, 10% resolving SDS-PAGE.

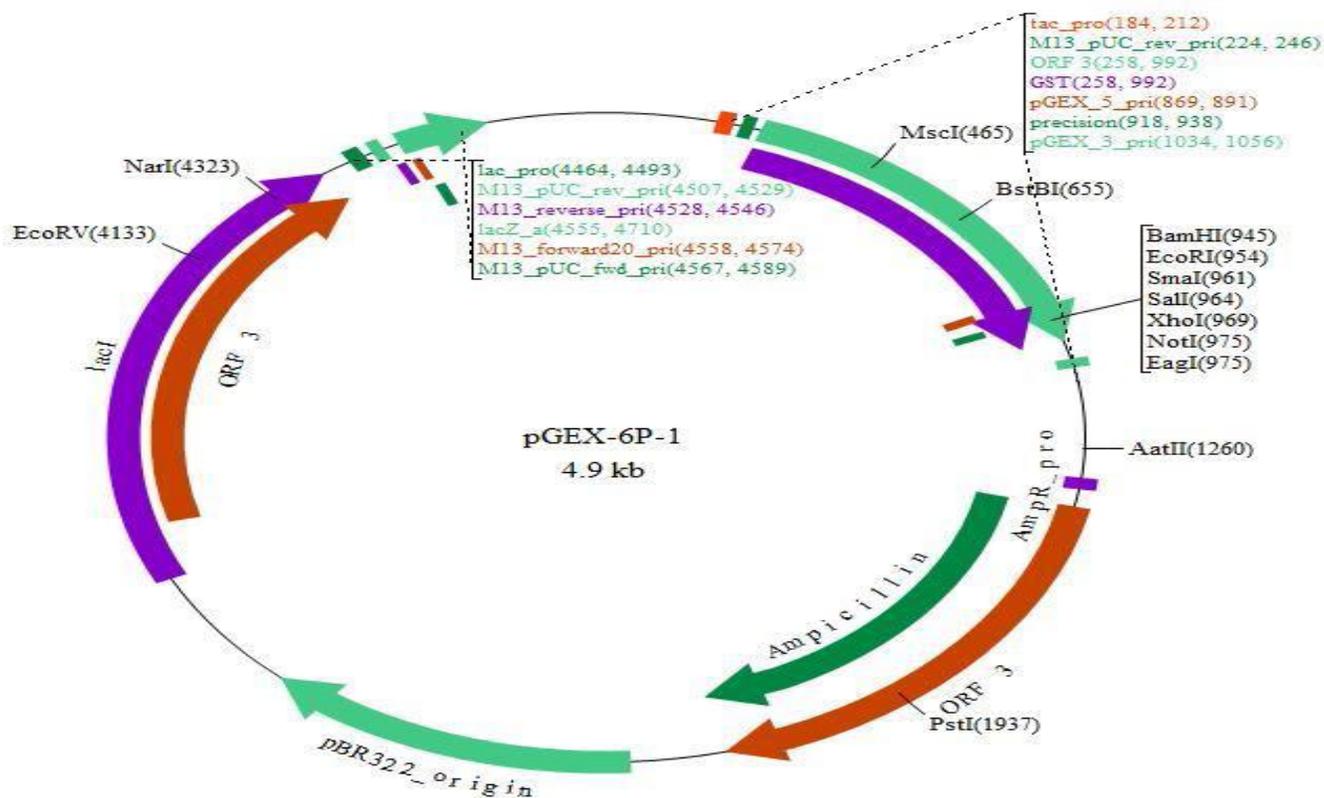


Figure 2: PGEX VECTOR: STRUCTURE

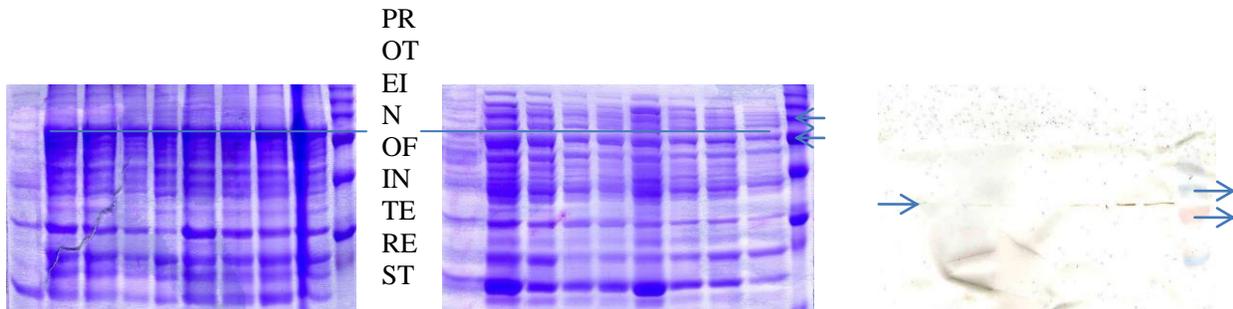


Figure 3: EXPRESSION CHECK (with 1mM IPTG & growth at 37 Degree temp) IN BL21 STRAIN OF Ecoli OF Pb268 IN PGEX VECTOR by SDS PAGE WESTERN BLOT.

- (a) PELLETT -1-UNINDUCED, 2 to10 INDUCED, 10-RECOM DUAL RANGE PROTEIN MARKER  
(b) SUPERNATANT- 1-UNINDUCED, 2 to10 INDUCED, 10-RECOM DUAL RANGE PROTEINMARKER  
(c) WETERN BLOT-WEAK EXPRESSION IN 4, 7, 8, 9, LADDER at 10.

#### IV. CONCLUSIONS

The fig. 3 shows that our protein of interest of 75 Kda is partially coming in pellet fractions (fig 3a) and partially in supernatant fractions (fig 3b). Because we wanted to obtain our protein in supernatant fractions, we performed western blot of supernatant fractions to further confirm expression of desired protein. In western blot (fig. 3c), it can be seen that very weak expression in lane 4,7,8,9 were coming. The possible reasons could be:

- Initially we were trying to express Pb000268.02.00 (only C-terminus) in pGEX vector in *E. coli* (BL21 strain). Later on we found that gene's database had been updated and an N-terminus was also included in its database and new gene was renamed as Pb122500. So it justifies weak or no expression of pb000268.02.0 in *E. Coli*(BL21 strain).
- Since this gene codes for a "putative kinase domain" containing protein, a basal/leaky expression is sufficient to interfere host metabolism and to kill the host cell.
- Large insert size may lead to unstable plasmid. Due to large vector-insert construct, host is not able to replicate, so plasmid is lost and only weak/leaky expression is obtained..

#### ACKNOWLEDGEMENT

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# Microbial enzymes and their applications in biotechnological processes

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## Abstract

This article focuses on the study of the enzymes produced by microorganisms, which have been extensively studied worldwide for their isolation, purification and characterization of their specific properties. Specific microorganisms have been isolated from extreme sources under extreme culture conditions, with the objective that such isolated microbes would possess the capability to bio-synthesize special enzymes. Various offline and online primary resources and literatures have been surveyed and reviewed for this study. Many Bio-industries require enzymes possessing special characteristics for their applications in processing of substrates and raw materials. These enzymes act as bio-catalysts to perform reactions in bio-processes in an economical and environmentally-friendly way as opposed to the use of chemical catalysts. The special characteristics of enzymes are exploited for their commercial interest and industrial applications, which include: tolerance to a varied range of pH, stability of enzyme activity over a range of temperature and pH, thermotolerance, thermophilic nature and other harsh reaction conditions. These microbial enzymes have proven their utility in bio-industries such as food, leather, textiles, animal feed, and in bio-conversions and bio-remediations.

**Keywords:** microbial-enzymes; thermophilic; alkalophilic; thermostable; protease; keratinase; amylase; xylanase; laccase

## I. Introduction

Enzymes are the bio-catalysts playing an important role in all stages of metabolism and biochemical reactions. Certain enzymes are of special interest and are utilized as organic catalysts in numerous processes on an

industrial scale. Microbial enzymes are known to be superior enzymes obtained from different microorganisms, particularly for applications in industries on commercial scales. Though the enzymes were discovered from microorganisms in the 20th century, studies on their isolation, characterization of properties, production on bench-scale to pilot-scale and their application in bio-industry have continuously progressed, and the knowledge has regularly been updated. Many enzymes from microbial sources are already being used in various commercial processes. Selected microorganisms including bacteria, fungi and yeasts have been globally studied for the bio-synthesis of economically viable preparations of various enzymes for commercial applications [1]. In conventional catalytic reactions using biocatalysts the use of enzymes, either in free or in immobilized forms, is dependent on the specificity of enzyme. In recent advances of biotechnology, according to the requirements of a process, various enzymes have been and are being designed or purposely engineered. Various established classes of enzymes are specific to perform specialized catalytic reactions and have established their uses in selected bio-processes. A large number of new enzymes have been designed with the input of protein-engineering, biochemical-reaction engineering and metagenomics. Various molecular techniques have also been applied to improve the quality and performance of microbial enzymes for their wider applications in many industries [2]. As a result, many added-value products are being synthesized in global market with the use of established bioprocess-technology employing purposely engineered biocatalyst-enzymes. Most of the commercially applicable proteases are alkaline and are bio-synthesized mainly by bacteria such as *Pseudomonas*, *Bacillus*, and *Clostridium*, and some fungi are also reported to produce these enzymes [3]. The xylanases with significant applications in bio-industries are produced by the fungal species belonging to genera *Trichoderma*, *Penicillium* and *Aspergillus*; the xylanases produced by these microorganisms have been found to possess high activity over a wide range of temperatures (40–60 °C) [4].

## II. Enzymes with Special Characteristics

Special characteristics of microbial enzymes include their capability and appreciable activity under abnormal conditions, mainly of temperature and pH. Hence, certain microbial enzymes are categorized as thermophilic,

acidophilic or alkalophilic. Microorganisms with systems of thermostable enzymes that can function at higher than normal reaction temperatures would decrease the possibility of microbial contamination in large scale industrial reactions of prolonged durations [5–7]. The quality of thermostability in enzymes promotes the breakdown and digestion of raw materials; also the higher reaction temperature enhances the penetration of enzymes [8]. The complete saccharification and hydrolysis of polysaccharides containing agricultural residues requires a longer reaction time, which is often associated with the contamination risks over a period of time. Therefore, the hydrolytic enzymes are well sought after, being active at higher temperatures as well as retaining stability over a prolonged period of processing at a range of temperatures. The high temperature enzymes also help in enhancing the mass-transfer and reduction of the substrate viscosity [9,10] during the progress of hydrolysis of substrates or raw materials in industrial processes. Thermophilic xylanase are considered to be of commercial interest in many industries particularly in the mashing process of brewing. The thermostable plant xerophytic isoforms of laccase enzyme are considered to be useful for their applications in textile, dyeing, pulping and bioremediation [1,4].

### **III. Enzymes with Special Characteristics in Biotechnology**

#### *1. Protease*

Though the hydrolytic enzymes belong to the largest group of enzymes and are the most commercially-applicable enzymes, among the enzymes within this group the microbial proteases have been extensively studied [11–16]. Proteases prepared from microbial systems are of three types: acidic, neutral and alkaline. Alkaline proteases are efficient under alkaline pH conditions and consist of a serine residue at their active site [15]. Alkaline serine proteases have the largest applications in bio-industry. Alkaline proteases are of particular interest being more suitable for a wide range of applications, since these possess high activity and stability in abnormal conditions of extreme physiological parameters. Alkaline proteases have shown their capability to work under high pH, temperature and in presence of inhibitory compounds [15–18].

Vijayalakshmi *et al.* [16] have optimized and characterized the cultural conditions for the production of alkalophilic as well as a thermophilic extracellular protease enzyme from *Bacillus*. This bacteria named *Bacillus* RV.B2.90 was found to be capable of producing an enzyme preparation possessing special characteristics such as being highly alkalophilic, moderately halophilic, thermophilic, and exhibiting the quality of a thermostable protease enzyme. Alkaline proteases possess the property of a great stability in their enzyme activity when used in detergents [16,18,19]. The alkaline protease produced from *Bacilli* and proteases from other microorganisms have found more applications overall in bio-industries such as: washing powders, tannery, food-industry, leather processing, pharmaceuticals, for studies in molecular biology and in peptide synthesis [1,3].

## 2. Keratinases

Keratin is an insoluble and fibrous structural protein that is a constituent of feathers and wool. The protein is abundantly available as a by-product from keratinous wastes, representing a valuable source of proteins and amino acids that could be useful for animal feeds or as a source of nitrogen for plants [20]. However, the keratin-containing substrates and materials have high mechanical stability and hence are difficult to be degraded by common proteases. Keratinases are specific proteolytic enzymes which are capable of degrading insoluble keratins. The importance of these enzymes is being increasingly recognized in fields as diverse as animal feed production, textile processing, detergent formulation, leather manufacture, and medicine. Proteolytic enzymes with specialized keratinase activity are required to degrade keratins and for this purpose the keratinases have been isolated and purified from certain bacteria, actinomycetes, and fungi [20,21].

Keratinases have been classified as serine- or metallo-proteases. Cloning and expression of keratinase genes in a variety of expression systems have also been reported [22]. A higher operation temperature is required in the degradation of materials like feathers and wool, which would be possible using a thermostable keratinase. This aspect is of added advantage in achieving a higher reactivity due to lower diffusional restrictions and hence a higher reaction rate would be established. The enhanced stability of keratinase would increase the overall

process yield due to the increased solubility of keratin and favorable equilibrium displacement in endothermic reactions.

Baihong *et al.* [23] have reported the enhanced thermostability of a preparation of keratinase by computational design and empirical mutation. The quadruple mutant of *Bacillus subtilis* has been characterised to exhibit the synergistic and additive effects at 60 °C with an increase of 8.6-fold in the  $t_{1/2}$  value. The N122Y substitution also led to an approximately 5.6-fold increase in catalytic efficiency compared to that of the wild-type keratinase.

An alkalophilic strain of *Streptomyces albidoflavus* has been reported to produce extracellular proteases [24]. This particular type of protease was capable of hydrolyzing keratin. The biosynthesis of this specific enzyme was optimized in submerged batch cultures at highly alkaline pH 10.5 and the enzyme yield was stimulated by using an inducer substrate containing keratin in the form of white chicken feathers. An enhanced (six-fold) protease production could be achieved with modified composition of culture-medium containing inducer at the concentration of 0.8% in the fermentation medium. The novelty of this crude enzyme has been reported to be its activity and stability in neutral and alkaline conditions. The maximum activity has been obtained at pH 9.0 and in the temperature range of 60–70 °C. This type of protease (keratinase- hydrolyzing keratins) is of particular significance for its application in industries since the crude enzyme showed its tolerance to the detergents and solvents tested [24]. Liu *et al.* [25] have studied the expression of extreme alkaline, oxidation-resistant keratinase from *Bacillus licheniformis* into the recombinant *Bacillus subtilis* WB600 expression system. The alkaline keratinase was characterized for its application in the processing of wool fibers.

### 3. Amylase

Amylases are significant enzymes for their specific use in the industrial starch conversion process [26]. Amylolytic enzymes act on starch and related oligo- and polysaccharides [27]. The global research on starch hydrolyzing enzymes based on the DNA sequence, structural analysis and catalytic mechanism has led to the

concept of one enzyme family—the alpha amylase. The amylolytic and related enzymes have been classified as glycoside hydrolases. The enzymes have been produced by a wide range of microorganisms and substrates [28–30] and categorized as exo-, endo-, de-branching and cyclodextrin producing enzyme. The application of these enzymes has been established in starch liquefaction, paper, food, sugar and pharmaceutical industries. In the food industry amylolytic enzymes have a large scale of applications, such as the production of glucose syrups, high fructose corn syrups, maltose syrup, reduction of viscosity of sugar syrups, reduction of turbidity to produce clarified fruit juice for longer shelf-life, solubilisation and saccharification of starch in the brewing industry [31]. The baking industry uses amylases to delay the staling of bread and other baked products; the paper industry uses amylases for the reduction of starch viscosity to achieve the appropriate coating of paper. Amylase enzyme is used in the textile industry for warp sizing of textile fibers, and used as a digestive aid in the pharmaceutical industry [28].

Li *et al.* [32] have recently isolated, characterized and cloned a thermotolerant isoamylase. For this purpose the enzyme was bio-synthesized using a thermophilic bacterium *Bacillus* sp. This novel enzyme has been reported to display its optimal activity at a remarkably high temperature of 70 °C, as well as being active in the alkaline range. This thermophilic enzyme has also been found to be thermo-stable between 30 and 70 °C, and its activity has been reported to be stable within a pH range of 5.5 to 9.0.

Gurumurthy *et al.* [33] completed the molecular characterization of an extremely thermostable alpha-amylase for industrial applications. This novel enzyme was produced by a bacterium *Geobacillus* sp which was isolated from the thermal water of a geothermal spring. This isolated bacterium showed the characteristics of thermo-tolerance and alkali-resistance. A purified preparation of amylase suitable for application was obtained using a DEAE-cellulose column and Sephadex G-150 gel filtration chromatography. The enzyme is a novel alpha-amylase due to its optimum activity at a very high temperature of 90 °C and an alkaline pH 8.0. However, this purified preparation enzyme was found to be stable only for 10 min at 90 °C.

#### 4. Xylanase

Hemicellulose is one of main constituents of agricultural residues and plants along with cellulose, lignin and pectin [34]. Xylan is the major component of hemicellulose consisting of  $\beta$ -1,4-linked D-xylopyranosyl residues. The hydrolysis of xylan in plant materials is achieved by the use of a mixture of hydrolytic enzymes including endo- $\beta$ -1,4-xylanase and  $\beta$ -D-xylosidase [35]. The importance of xylanase has tremendously increased due to its biotechnological applications for pentose production, fruit-juice clarification, improving rumen digestion and the bioconversion of lignocellulosic agricultural residues to fuels and chemicals [34]. Collins *et al.* [36] have extensively studied the xylanase enzyme and its families as well as the special xylanases possessing extremophilic characteristics. Xylanases have established their uses in the food, pulp, paper and textile industries, agri-industrial residues utilization, and ethanol and animal feed production [37,38].

The enzyme used for the purpose of bio-bleaching of wood pulp should be active in the conditions of alkaline pH, high temperature and at the same time it is desirable that this enzyme is stable at high reaction temperatures. Xylanase preparations used for wood processing in the paper industry should be free of cellulose activity. Cellulase-free xylanase preparations have applications in the paper industry to provide brightness to the paper due to their preferential solubilisation of xylans in plant materials and selective removal of hemicelluloses from the kraft-pulp. Kohli *et al.* [39] have studied the production of a cellulase free extracellular endo-1,4- $\beta$ -xylanase at a higher temperature of 50 °C and at pH 8.5 employing a selected microorganism: *Thermoactinomyces thalophilus*. The enzyme preparation was found to be thermostable at 65 °C, retaining its activity at 50% after 125 min of incubation at 65 °C. The crude enzyme preparation showed no cellulase activity and the optimum temperature and pH for maximum xylanase activity was found to be 65 °C and 8.5–9.0, respectively. A thermotolerant and alkalotolerant xylanase has been reported to be produced by *Bacillus* sp [40]. To make the applications of xylanase viable on commercial scales, heterologous systems of *Escherichia coli*, *Pichia pastoris* and *Bacillus* sp have been used to express xylanase activity [41,42]. The thermophilic microorganism *Humicola* spp. has been studied for its capability of bio-synthesising an alkali-tolerant  $\beta$ -mannase xylanase [43]. Acidophilic xylanases stable under acidic conditions of reaction are reported

to be produced by an acidophilic fungus *Bispora*[44], in contrast a xylanase active under conditions of alkaline pH has been studied by Mamoet *al.* [45] for the mechanism of their high pH catalytic adaptation.

Recently three novel xylanases thermophilic in nature (XynA,B,C) have been characterized by Yanlong *et al.* [46], these were produced by *Humicolasp.* for their potential applications in the brewing industry. One xylanase gene, XynA, has been found to adapt to alkaline conditions and stability at higher temperatures. This XynA also possessed higher catalytic efficiency and specificity for a range of substrates. Yanlong *et al.* [46] have reported the application of three xylanases, XynA-C, in simulated mashing conditions in the brewing industry and found the better performance of 37% on filtration acceleration and 13% reduction in viscosity of substrate in comparison to the performance of a commercial trade enzyme, Ultraflo, a product from Novozyme.

##### 5. Laccase/Ligninase

Ligninolytic enzymes are applicable in the hydrolysis of lignocellulosic agricultural residues, particularly for the degradation of the complex and recalcitrant constituent lignin. This group of enzymes is a mixture of synergistic enzymes, hence they are highly versatile in nature and can be used in a range of industrial processes [47–49]. The complex enzyme system consists of three oxidative enzymes: lignin peroxidase (LiP), manganese peroxidase (MnP) and laccase. These enzymes have established their applications in bio-remediation, pollution control and in the treatment of industrial effluents containing recalcitrant and hazardous chemicals such as textile dyes, phenols and other xenobiotics [50–53].

The paper and pulp industry requires a step of separation and degradation of lignin from plant material, where the pretreatment of wood pulp using ligninolytic enzymes is important for a milder and cleaner strategy of lignin removal compared to chemical bleaching. Bleach enhancement of mixed wood pulp has been achieved using co-culture strategies, through the combined activity of xylanase and laccase [54]. The ligninolytic enzyme system is used in bio-bleaching of craft pulp and in other industries such as for the stabilization of wine and fruit juices, denim washing [49], the cosmetic industry and biosensors [1,34]. Fungi are the most potent producers of lignin degrading enzymes. White rot fungi have been specifically studied for the production of

these enzymes by Robinson *et al.* [50–52]. For the economical production of ligninolytic enzymes, agricultural residues have been used as the substrate in microbial production of lignin degrading enzymes [34].

Thermophilic laccase enzyme is of particular use in the pulping industry. Recently, Gali and Kotteazeth [55] reported the biophysical characterization of thermophilic laccase isoforms. These were initially isolated from the xerophytic plant species *Cereus pterogonus* and *Opuntia vulgaris* and showed thermophilic property [56–58]. In order to prepare laccase enzymes with special characteristics, several studies have been conducted to provide a scientific basis for the employment of laccases in biotechnological processes [59–62]. Forms of laccase with unusual properties have been isolated from the basidiomycetes culture of *Steccherinum ochraceum* [63], *Polyporus versicolor* [64] and a microbial consortium [65].

## 6. Cellulase

Cellulase enzymes are the third most important enzyme for industrial uses: world-wide research has been focused on the commercial potential of cellulolytic enzymes for the commercial production of glucose feedstock from the agricultural cellulosic materials [1]. The significance of cellulose hydrolyzing thermophilic enzymes in various industries includes the production of bio-ethanol and value-added organic compounds from renewable agricultural residues [66]. Cellulose is the most abundant natural resource available globally for bioconversion into numerous products in bio-industry on a commercial scale. For efficient bioconversion a strategy of efficient saccharification using cellulolytic enzymes is required. Hardiman *et al.* [66] used the approach of thermophilic directed evolution of a thermophilic  $\beta$ -glucosidase.

Cellulase is complex of three important enzymes which work synergistically owing to the crystalline and amorphous complex structure of cellulose. These enzymes, acting synergistically, hydrolyse cellulose to cellobiose, glucose and oligo-saccharides. Endoglucanase enzyme is the first one acting on amorphous cellulose fibers, attacking the glucose-polymer chain randomly, which releases small fibers consisting of free-reducing and non-reducing ends. The free-ends of the chain are then exposed to the activity of exoglucanase enzyme,

which produces cellobiose. The third component of cellulase is  $\beta$ -glucosidase, which hydrolyses the cellobiose, producing the glucose as the final product of cellulose saccharification.

Thermostability is an important technical property for cellulases: since the saccharification of cellulose is faster at higher temperatures, the stability of enzyme activity is necessary to be maintained for the completion of the process. Though the enzymes have been prepared using thermophilic microorganisms, these enzyme preparations are not necessarily heat-stable. The activity profile for the thermal activation and stability of cellulases derived from two *Basidiomycetes* cultures was studied by Nigam and Prabhu [67]. The results proved that the prior heat-treatment of enzyme preparation caused activation of exo- and endo-glucanase activities, and improved the stability of enzymes over a period of reaction time. Therefore, the efficiency of cellulolytic enzymes may be increased by heat-treatment, by incubating buffered enzyme preparations without cellulose or substrates prior to the saccharification process [67].

Cellulolytic enzymes have been produced by a range of microorganisms including bacteria and fungi. The studies have been performed for the biosynthesis of a high-activity preparation in high yields [68–70]. Researchers have cultivated microorganisms to achieve cellulases of desired quality under submerged and solid state fermentation conditions for the economical production of enzyme using waste agricultural residues [1].

### 7. Miscellaneous Enzymes in Biotechnology

Various enzymes other than those described above have a significant place in the list of microbial enzymes, which have established their applications in bio-industries. Lipases have been widely studied for their properties and utilization in many industries [71–75]. Pectinases have established their role in the fruit and juice industries [76]. Certain enzymes are specifically required in pharmaceutical industry for diagnostic kits and analytical assays [77–80].

Bornscheuer *et al.* [81] have currently mentioned that in all the research and developments so far in the field of biocatalysis, the researchers have contributed in three waves of outcomes. These innovations have played an important role in the establishment of current commercially successful level of bio-industries. As a result recent

bioprocess-technology is capable of meeting future challenges and the requirements of conventional and modern industries, for example Trincone [82] has reviewed the options for unique enzymatic preparation of glycosides. Earlier enzymatic process were performed within the limitations of an enzyme, whereas currently with the knowledge of modern techniques, the enzyme can be engineered to be a suitable biocatalyst to meet the process requirement. Riva [83] has identified the scope of a long-term research in biocatalysis, since there are underlying problems in the shift from classical processes to bio-based processes for commercial market.

Table 1 summarizes some enzymes produced by microorganisms possessing special characteristics useful in various bio-processes. There is a tremendous scope for research and development to meet the challenges of third generation biorefineries [83], for the production of numerous chemicals and bio-products from renewable biomasses [34]; or by the new glycoside hydrolases [82]; or new enzymes found in marine environments [84]. Although the research for the hemicellulases as important biorefining enzymes has not well established, biocatalysis for xylan processing is slowly progressing and a wide range of hemicellulases have been isolated and characterized [85]. Specifically about the biobased glycosynthesis, Trincone [82] has mentioned that the new prospects are open for the use of pentose sugars as main building blocks for engineered pentosides to be used as non-ionic surfactants or as the ingredients for prebiotic food and feed preparations.

**Table 1.** A summarized overview of some microbial enzymes with special characteristics of industrial importance.

Enzyme	Properties	Producer Microbes-	Applications	Referenc e
PROTEASE (Proteolytic activity)				[1,3,11– 19,34]

	Acidic, Neutral, Alkaline, Thermophilic, Active in presence of inhibitory compounds	<i>Bacilli;</i> <i>Pseudomonas; Clostridium;</i> <i>Rhizopus; Penicillium;</i> <i>Aspergillus</i>	Washing Powders; Detergents; Tannery; Food Industry; Leather processing; Pharmaceuticals; Molec ular Biology; Peptide synthesis	
KERATINA SE (Keratin- hydrolysing activity)	Specific Proteolytic Activity for Insoluble & Fibrous Proteins in furs, feathers, wool, hair; Thermophilic; Alkalophilic; Oxidation- Resistant	Bacteria; Actinomycetes; Fungi	Animal Feed Production; Textile Processing; Detergent Formulation; Leather Manufacturing; Medicine	[1,20– 25,34]
AMYLASE (Starch- hydrolyzing activity)	Thermotoleran t, Thermostable, Alkali- resistant-Exo-, endo-, de- branching,	<i>Bacillus sp.; Geobacillus</i>	Starch industry (for liquefaction); Paper, Food industry (Glucose & Maltose syrups, High Fructose Corn syrups, clarified fruit-juices);	[1,26–34]

	cyclodextrin-producing enzymes		Pharmaceutical industries (Digestive aid); Brewing Industry (Starch-processing); Textile industry (Warp-sizing of fibers); Baking industry (delayed staling)	
XYLANASE (Xylan–Pentose polymer hydrolyzing activity)	Extremophilic characteristics –Alkalophilic, Thermophilic & Thermostable	<i>Thermoactinomycesthalophilus</i> ; <i>Bacillus</i> sp.; <i>Humicolainsolens</i> . <i>Bispora</i> (acidophilic fungus)	Pentose production - Bioconversion of hemicellulose for fuel & Chemicals; Fruit-juice clarification; Improving rumen digestion; Paper industry- selective removals of xylans from kraft-pulp; Brewing industry	[1,34–46]
LIGNINASE (Ligninolytic-Complex-enzyme)	Oxidative properties in Lignin peroxidase, Manganese peroxidase & Laccase; Thermophilic	Basidiomycetes strains— <i>Steccherinumochraceum</i> , <i>Polyporus versicolor</i> , <i>Panustigrinus</i>	Denim washing; Biosensors; Bio-bleaching of Kraft-pulp; Bioremediation; Pollution-control; Treatment of recalcitrant chemicals in Textile and Industrial	[1,34,47–65]

			effluents	
CELLULASE (Cellulolytic-complex enzyme)	Saccharification of crystalline & amorphous cellulose; Thermophilic; Thermostable	Basidiomycetes strains <i>Polyporus</i> sp.; <i>Pleurotus</i> sp.; <i>Trichoderma</i> sp.; <i>Aspergillus</i> sp.	Glucose feedstock from cellulose; Bio-refinery; Bio-ethanol; Paper-pulp industry	[1,34,66–70]
LIPASE	Fat-splitting; Stereoselectivity; Racemic-Resolution activity; Solvents-resistant; Thermotolerant	Yeasts and Fungal strains- <i>Candida</i> sp., <i>Aspergillus</i> sp., <i>Penicillium</i> sp., <i>Rhizopus</i> , <i>Mucor</i>	Detergents; Dairy Industry-oils, fats, Butter, Cream, Fat-Spreads; Feed supplement; Therapeutic agent	[1,34,71–75]

#### IV. Conclusions

Biotechnology is utilizing a wide range of enzymes synthesized on a commercial scale employing purposely screened microorganisms. Selected microorganisms have been characterized, purposely designed and optimized to produce a high-quality enzyme preparation on large scales for industrial applications. Different industries require enzymes for different purposes; hence microbial enzymes have been studied for their special characteristics applicable in various bio-processes. Recent molecular biology techniques have allowed to tailor a

specific microorganism, to produce not only the high yields of an enzyme, but also enzyme with desired special characteristics such as thermostability, tolerance at high temperature and its stability in acidic or alkaline environment, and retaining the enzyme activity under severe reaction conditions such as in presence of other metals etc.

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# “Effect of the social media on to the personalities in context of their choices and perceptions”

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**Abstract:** There are little facts about the role of reel self of a person when it comes to the role of social Medias and internet in the life of a person. Social media is providing yet one more means of engaging with people on this vast planet of ours, and if used effectively can give all of us greater choice in how we live and what happens in our world [1]. Most theories suggest that people get adversely affected and influenced by the internet and social Medias. Our experiment tested people's reaction to social media and the change appearing due to it in their choices and perceptions. The results showed that almost everyone gets a new definition of personality after entering into the world of internet and social media. The conclusion is that when it comes to people choices they are adapting all that is not at all relevant to their likings and disliking's but is as per the environment they are living in to. This directly shows a development of new complex and diplomatic personality traits that are very difficult to understand and predict.

When females are exposed to models for a short duration, it has an effect on their body satisfaction and self-esteem [2]. What if females are exposed to other female celebrities and models on an every-day basis by following them on a social media platform such as Instagram, for an even longer period of time? These models and celebrities become their social comparison group by seeing their pictures of their beauty and their lavish lifestyles every single day. Visual platforms like Facebook, Instagram and Snapchat deliver the tools that allow teens to earn approval for their appearance and compare themselves to others. The most vulnerable users, researchers say, are the ones who spend most of their time posting, commenting on and comparing themselves to photos [3]. Could this repeated exposure effect their self-esteem or life satisfaction?

**Index Terms:** Buying perceptions, social media, business management, demand forecast, market research.

## Introduction

Current theories focus on effects of the internet, celebrities, and social media onto the changing aspects of people life and living environment in every sense. Social comparison theory is a psychological theory originally coined by Leon Festinger in 1954. The social comparison theory explains how individuals compare themselves to others to evaluate their own opinions and abilities in order to reduce any uncertainty in these areas and to learn how to define the self. Social comparison can be a way of, self-enhancement by downward social comparisons, by means of looking for another individual or group that they consider to be worse off than them in order to feel better about them. It can also have a negative impact on an individual's self-report by means of upward comparisons when comparing themselves with others who are better off or superior. Such negative social comparisons are detrimental to the perceptions of the self [4].

One of the examples are “Celebrity endorsement” commonly used by fashion or beauty brands, to attract people's attention and is helpful in reaching a wider audience to raise their awareness towards a certain organization or an issue [5]. This has proved that celebrities have the potential to reach a lot of prospective consumers.

The media has been found to be the most powerful conveyor of socio-cultural values regarding body ideals, size and weight, which has been linked to body dissatisfaction and in turn, related to other health concerns such as depression, low self-esteem and eating disorders [6].

Many studies have shown that social media use causes individuals to create negative social comparisons with the people that they follow or are friends with on social media websites, which leads to negative effects on self-report.

This research is conducted to check the impact of social networking sites and internet media on the changing choices of an ideological self.

Collected data was analyzed in term of frequency, percentage, and mean score of statements. Findings show that the Majority of the respondents show the agreements with these influences of social media.

In this research, the main highlight is on the changing behaviors of people in their personal and social life because of their attachment or detachment to social media. It is no doubt that the Internet and the social media are powerful instruments for mobilization of people [6]. As their saying every single person is somehow attached to it, this paper wants to set out a relation between the personality and behaviors.

### **This research is conducted into two phases:**

- 1- In what way media is affecting someone's ideology
- 2- Effect of these ideologies on their buying behavior in the market.

This experimental research was conducted to conclude that if this new media inspired ideology (the reel self) of a person is affecting the buying pattern or not?

## **Methods**

### **Participants**

There were male 30 participants participating. They were recruited according to their age, class of living, religion, and education respectively.

This experiment will be done for categories:

- Adults
  - a) High class highly educated
  - b) Middle class highly educated
  - c) Lower class highly educated
  - d) High class, less educated
  - e) Middle class, less educated
  - f) Lower class, less educated
- Elderlies:

- a) High class highly educated
- b) Middle class highly educated
- c) Lower class highly educated
- d) High class, less educated
- e) Middle class, less educated
- f) Lower class, less educated

### **Instruments**

A "survey paper" was used to trick the participants into thinking that what they unexpectedly grasp from the media. What are their thoughts and beliefs about some general things and media related things? Then through that paper, a relation will be perceived of how much different they are while making personal decisions and what changes appeared after being into touch with media.

Next, an experiment was conducted using the method of experimental research in which the panel of participants was asked to shop twice once before the experiment and once after the experiment to evaluate the exact difference in their buying behavior.

### **Procedures**

The participant of different age was taken from the same family. Each "participant" was asked to fill the data form before the experiment. The other "participant" was an actor. Each participant got the role as a "shopper" who will be exposed to a fashion promoting video and then will be exposed to a shopping center. They will be provided by an exposure of real shopping.

The learner was a confederate who would pretend to be a seller. As the experiment progressed, the shopping will be evaluated and compared to the shopping prior to the video experiment and the results will be calculated.

### **Results**

Of the 20 participants in the study, 14 delivered the actual resemblance of the dresses they visualized in the video, 2 persons did not obey the experimenter and stopped before reaching the final level of shopping. All 20 participants continued to shop for 15 minutes.

### **Discussion/Conclusion**

Most of the participants became very excited and interested just after watching out their favourite celebrity's lavishness & experimentations with the designs. Many continued to follow orders all the time even though they were clearly uncomfortable. The study showed that people are magnificently different in their shopping speeds and opting powers after the experiment. It showed that the situation is far more important than previously believed and that personal characteristics are less important in such a situation.

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# Effect of Leguminous Plant leaves used as soil amendment on the Growth of *Celosia argentea* L.

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**ABSTRACT:** Pot experiments were conducted during the planting season of 2015 at the green house of the Federal College of Forestry, Ibadan to evaluate the effect of leguminous plant leaf compost on the growth and yield of *Celosia argentea* L. There were six treatments including control (leaves of *Chromolaena odorata*, *Cedrela odorata*, *Vigna unguiculata*, *Albizia lebbek*, and *Mucuna poggei* ) The experiment was laid out in a Complete Randomized Design (CRD) and replicated five times. Leaf composts were applied at the rate of 200g/2kg of top soil. Data were collected on plant height, number of leaves, stem girth and yield for twelve weeks. Data collected were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan Multiple Range Test (DMRT). The results showed that *C.argentea* treated with *Mucuna poggei* leaf compost significantly ( $p<0.05$ ) gave the highest plant height compared to other treatments and control. Similarly, *Mucuna poggei* leaf compost significantly ( $p<0.05$ ) gave the highest leaves production and stem girth compared to other treatment and control. Highest yield was recorded on plant treated with *Mucuna poggei* compost (67.60g/plant). Therefore, use of *Mucuna poggei* leaf compost as soil amendment for the cultivation of leafy vegetable should be encouraged since it enhances plant growth, yield readily available and environmentally safe.

**Index terms:** *Celosia argentea*, compost manure, growth, soil amendment, yield

## 1. INTRODUCTION

Soil nutrients depletion is one of the major problems currently affecting crop production in many countries of the tropics, including Nigeria. The increase in crop cultivation with little or no soil fertility management has been one of the vital factors contributing to the reduction in natural ecological balances in the land. The effect poses great hardship for productivity increase to meet the food needs of a rapidly rising population, thus endangering food security [1]

*Celosia argentea* L. 'Lagos spinach' of the family *Amaranthaceae* is one of the main green leafy vegetable in West Africa. It is known as *Sokoyoto* (Yoruba) or *Farar atayyato* (Hausa) [2] They grow best in full sunlight in a well drained fertile soil. They produce flower head within eight weeks and further growth can be promoted by removing dead flowers [3]. *Celosia argentea* contains protein, fat, and varying proportions of vitamin B complex (vitamin B1, vitamin B3 e.t.c) vitamin C, vitamin E, carbohydrates such as starch, sugar and dietary

minerals such as nitrogen, calcium, iron, magnesium etc. The century cultivars are usually taller (1-2 feet) than other cultivars and are bright red, yellow, orange or pink in colour [4]. It is used in Africa to help control growth of the parasitic striga plant [5] (Palada *et al* 2013). In Africa and especially Southwest Ethiopia, the stem and leaves of *Celosia* are applied as poultice and used for treating infected sores, wounds, and slum eruptions, the poultice of leaves smeared with honey are used as cooling application to inflamed area and painful infections such as buboes and abscesses. [6] Production *C. argentea* in Nigeria to meet the demand of the populace has currently decline due to soil infertility and other associated problems like pests resulting to high cost of the available produce. The diminution of soil nutrients due to continuous cropping reduces the soil organic matter, cause acidification and yield reduction of crops [7-9]. The use of inorganic fertilizer to enhance crop yields has become an important alternative for improving soil fertility and productivity. Although high crop yield are obtained with the application of inorganic fertilizers, it has both economic and environmental implications. This necessitated the search for alternative sources of maintaining the fertility of the soil. The uses of organic sources of nutrients are normally anticipated as alternatives to inorganic fertilizers due to their various negative implications. According to Makumba [10] the inability of most resource-poor farmers to afford inorganic fertilizer has made organic amendment a viable alternative source of soil fertility replenishment in low-input smallholder farming systems. The use of traditional organic materials such as crop residues and animal manure cannot alone reverse soil fertility decline because they are usually not available in sufficient quantities on most farms and their processing as well as application is labour intensive [11]. The use of tree biomass as soil amendment for crop production can offers long term solution to soil problems as compared to inorganic fertilizer and animal source of organic fertilizer Several tree biomass especially the leguminous ones such as *Gliricidia sepium*, *Albizialebeck*, *Albizia zygia*, *Leucaena leucocephala* and *Azadirachta indicat* can be used as amendments to improve the fertility of soil [12]. This study was therefore conducted to assess the effect of different leguminous plant leaves used as soil amendment on the growth and yield of *Celosia argentea* by mixing the soil with leaf compost.

## II MATERIALS AND METHODS

### 2.1. Study Area

The experiment was conducted in a green house of the Federal College of Forestry, Jericho, Ibadan. The college is located on the Latitude 7<sup>0</sup>26'N and Longitude 3<sup>0</sup>15'E. The climatic pattern of the area is tropically dominated by annual rainfall range from 1300-1500mm and has average relative humidity of about 65% and an average temperature which is about 26<sup>0</sup>c. The eco-climatic study of the area gives two distinct seasons; dry season, usually from November to March and the rainy season, from April to October [13]

### 2.2 Soil analysis

Before the commencement of the experiment, surface soil samples (0–15cm depth) were taken randomly from the college experimental sites. The samples were bulked (to make a composite sample), air dried and sieved using a 2mm sieve and analyzed for particle size, soil organic matter total N, P, K, Ca, Mg and pH. Particle size analysis was done using the hydrometer method [14]. Total nitrogen was determined by the macro-kjeldahl digestion method of Jackson [15] available P was extracted using Bray-1 extract followed by molybdenum blue colorimetry. Exchangeable cations were extracted with 1M NH<sub>4</sub>OAC (pH 7.0), potassium, calcium and sodium were determined using flame photometer and exchangeable Mg by atomic absorption spectrophotometer [16]. Soil pH was determined in 1:2 soil:water ratio using digital electronic pH meter.

## 2.3 Experimental Procedures

*Celosia argentea* seeds were sourced from the National Horticultural Research Institute (NIHORT) Ibadan, and raised inside germination box packed with top soil in the Nursery of Federal College of Forestry, Ibadan. The seeds were sown using broadcasting method, watering was done daily until germination started and at three days intervals during the early growth. Fresh leaves of five leguminous plants (*Chromolaena odorata*, *Cedrela odorata*, *Vigna unguiculata*, *Albizia lebbbeck*, *Mucuna poggei*) were collected from Forestry Research Institute of Nigeria Jericho Hills Ibadan, cut into pieces and poured separately into air tight buckets and allowed to decompose for a period of six (6) weeks. After decomposition, 200g of each sample were weighed out, mixed with 2kg of top soil and poured into separate polythene pots. The mixtures were allowed to stay for 2 weeks before transplanting *Celosia* seedlings. The *Celosia* seedlings were transplanted into the prepared poly pots three weeks after planting. The experiment was arranged in Complete Randomized Design (CRD) in five replicates

## 2.4. Data Collection and Analysis

Agronomic attributes such plant height, stem diameter, number of leaves and yield of *C. argentea* were measured at two weeks intervals for 12 weeks. The plant height (cm) was measured with the aid of a meter rule from base to the tip of the main shoots, stem diameters (mm) were measured with the use of Venier caliper. The numbers of leaves were counted by observation and the use of hand while the yield was measured by weighing the plant after the experiment with a sensitive weighing scale. Data collected were subjected to Analysis of Variance (ANOVA) and significant means were separated using Duncan Multiple Range Test at 5% level of probability.

## III. RESULTS AND DISCUSSION

The properties of the soil used for the experiment are presented in Table 1. The soil was predominantly sandy and slightly acidic (pH = 6.59), low in nitrogen (0.11%), available phosphorus (5.69mg/kg) and potassium (0.36cmol/kg). The laboratory analysis of the compost used for the experiment are shown in Table 2. The various compost used were rich in Nitrogen and phosphorous. *Mucuna poggei* compost has the highest value of Nitrogen (3.425g/kg) followed by *Chromolaena odorata*(3.194g/kg) While *Vigna unguiculata* (1.436g/kg) leaves has least value of Nitrogen.

### 3.1 Effect of leaf compost on plant height (cm)

There was a general increase in plant heights after transplanting from week one to end of the experiment (12 weeks) for all the treatments (Table 3). The *Celosia* height was significantly ( $p < 0.05$ ) higher in the soil amended with *Mucuna poggei* leaf compost compared to other treatments. However, there were no significant differences among the heights of *Celosia* plants treated with other four leaf compost and control; though they recorded greater heights than control. This could be attributed to the fact that, the added amendment increased the supply of plant nutrient in the soil for the roots to access [17]. This confirms the suggestion by Janick [18] that higher availability of nutrients increases succulent growth of plants.

### 3.2 Effect of leaf compost on stem girth of *Celosia argentea*

There was a similar trend on the increase in stem girth of *C. argentea* after transplanting to the end of the experiment. The stem girth increased in all the amended soil. Plants amended with *Mucuna poggei* compost significantly ( $p < 0.05$ ) gave the highest stem girth compared to other treatments. (Table.4). it recorded mean value of 0,2mm at 12 weeks of the experiment while lowest stem girth was observed in untreated soil (control) with mean value of 0.15mm

This result is however lesser when compared with application of compost for planting *Celosia* done by Sanni [19] which gave a stem girth value of 3.60cm<sup>3</sup> four weeks after planting(4WAP). The higher growth observed in *Celosia* plants amended with *Mucuna poggei* could be attributed to the high total nitrogen content in the *Mucuna* leaves ( 3.425g/kg) table 2.

### 3.3. Effect of the leaf compost on *C. argentea* leaf production

Observations made on the number of leaves produced by *Celosia argentea* showed an increase from week 1 to week 12 (Table 5). *Celocia* plant treated with *Mucuna poggei* compost gave the highest number of leaves with mean value 77.12 while control has the lowest mean value of 29.12.

This indicates that *Mucuna poggei* as compost provides more yield when compared with other treatments, implying that it serves as the best amendment within the scope of the research work. *Mucuna poggei* compost significantly ( $p < 0.05$ ) gave the highest leaves production.

This result was higher than the number of leaves recorded by Babajide and Olla [20] with application of *Tithonia* compost and N-Mineral fertilizer on *Celosia* plant where they obtained mean value of 67.02 leaves.

### 3.4. Effect of compost on yield of *Celosia argentea*

The result showed that *Celosia* plant recorded higher yield in all the treatments compared to control. *Mucuna poggei* compost significantly ( $p < 0.05$ ) gave the highest yield of *Celosia argentea* with a mean value of 67.60g. This was followed by plants treated with *Chromolena odorata* and *Albizia lebbek* with mean values of 51.80 and 51. 20 respectively. This result supported the findings of Nanjundappa [21] and Imayavarambani [22] who reported improvement in the general performance of crops which received a combination of different nutrient sources. The outstanding performance of the *Mucuna poggei* compost over other compost could be attributed to the higher level of the micro nutrients (N,P and M) that are contained in the leaves compared to others. This assumption supports Adewale [23], who reported that increase in plant growth and yield as a result of application of organic manure is predictable in manure that contained and released considerable amount N and Mg for plant use during the process of mineralization. Similarly Senjobi [24] reported that the use of organic amendments produced significant effect on the performance of *Celosia* when compared with the control plants.

### 3.5. Conclusion and Recommendation

The application of leguminous leaf compost amendment improved growth over the control. Treatment effects on growth of *C. argentea* applied with *Mucuna poggei* compost significantly( $p < 0.05$ ) gave better results over other composts and control Therefore, *M. poggei leaf* compost amendment is recommended for use by farmers, as it has great prospects for soil fertility improvement and they are readily available as well environmentally safe

**Table 1 Physiochemical properties of experimental soil**

Composition	Values
pH in H <sub>2</sub> O	6.59

pH in KCl	6.35
Ca	4.40cmol/kg
K	0.36cmol/kg
Na	0.19cmol/kg
Mg	1.94cmol/kg
%C	1.74
Total N%	0.11
Av.P	5.69
Mn	19.79mg/kg
Fe	18.06mg/kg
Cu	0.38mg/kg
Zn	6.5mg/kg
Sand	812.0g/kg
Silt	64.0g/kg
clay	124.0g/kg
Texture class	Sandy loam

**Table 2: Laboratory Analysis of nutrients present in the composts used**

Samples	N(g/kg)	P (g/kg)	Ca g/kg)	Mg(g/kg)	K (g/kg)	Na(g/kg)
<i>Albizia lebbeck</i>	2.865	0.180	0.881	0.198	1.113	221.52
<i>Vigna unguiculata</i>	1.436	0.217	1.240	0.265	0.421	210.57
<i>Mucuna pogeii</i>	3.425	0.315	1.233	0.775	2.205	1310.05
<i>Chromolaena odorata</i>	3.194	0.299	4.430	0.315	1.318	725.01
<i>Cedrela odorata</i>	3.222	0.267	3.513	0.375	2.085	1055.22

**Table 3: Effect of the composts on height (cm) growth of *Celosia argentea***

Treatments	Weeks after Planting						Mean
	2	4	6	8	10	12	

<i>Mucuna poggei</i>	14.64a	16.28b	17.40a	21.58a	23.28a	25.18a	19.74a
<i>Chromolena odorata</i>	14.48a	15.90b	17.36a	19.34b	20.98bc	22.38bc	18.06b
<i>Cedrela odorata</i>	14.58a	16.30b	17.66a	18.78b	21.10bc	22.94bc	17.88b
<i>Vigna unguiculata</i>	14.50a	16.50b	18.34a	19.12b	20.52bc	22.66bc	18.06b
<i>Albizia lebbek</i>	15.10a	17.56a	19.18a	19.92b	21.62bc	23.44b	18.36b
<b>Control</b>	14.70a	15.90b	17.16a	18.60b	19.78c	21.52c	17.66b
<b>CV</b>	3.78	4.54	4.56	4.99	5.11	4.61	3.70

**NOTE:** Means with the same letters are not significantly different from each other at 5% probability level.

**Table 4: Effect of the composts on stem diameter of *Celosia argentea***

Treatments	Weeks after Planting						Mean
	2	4	6	8	10	12	
<i>Mucuna poggei</i>	0.13b	0.15b	0.16a	0.19ab	0.20a	0.20a	0.20a
<i>Chromolena odorata</i>	0.14b	0.15ab	0.17ab	0.18ab	0.20ab	0.16ab	0.16ab
<i>Cedrela odorata</i>	0.14b	0.15ab	0.16ab	0.17c	0.18ab	0.20ab	0.16ab
<i>Vigna unguiculata</i>	0.14b	0.15ab	0.17ab	0.18bc	0.19ab	0.20ab	0.16b
<i>Albizia lebbek</i>	0.15a	0.17a	0.18a	0.19a	0.19ab	0.20a	0.17ab
<b>Control</b>	0.13b	0.15b	0.16ab	0.16c	0.18b	0.19b	0.15b

<b>CV</b>	9.27	10.13	8.78	7.36	7.82	6.71	8.69
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**NOTE:** Means with the same letters are not significantly different from each other at 5% probability level

**Table 5: Effect of the composts on leaf production of *Celosia argentea***

<b>Treatments</b>	<b>Weeks after Planting</b>						<b>Mean</b>
	<b>2</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>10</b>	<b>12</b>	
<i>Mucuna poggei</i>	10.00a	15.20bc	19.60c	46.40a	70.60a	80.20a	77.12a
<i>Chromolena odorata</i>	10.60a	15.60ab	21.00bc	32.40c	52.40b	63.60b	32.34b
<i>Cedrela odorata</i>	7.40a	16.00ab	20.80bc	28.60c	52.40b	65.40b	30.44b
<i>Vigna unguiculata</i>	10.40a	17.20ab	23.60ab	34.00c	49.00bc	66.00b	38.62b
<i>Albizia lebbek</i>	10.00a	15.20bc	19.60c	46.40a	70.60a	80.20a	77.12a
<b>Control</b>	9.80a	13.40c	17.80c	30.40c	44.60c	54.40c	29.12b
<b>CV</b>	25.22	15.14	11.68	11.63	9.78	10.08	13.94

**NOTE:** Means with the same letters are not significantly different from each other at 5% probability level

**Table 6: Effect of the composts on the yield of *Celosia argentea***

<b>Treatments</b>	<b>Weeks after Planting</b>
	<b>Weight(kg)</b>
<i>Mucuna poggei</i>	67.60
<i>Chromolena odorata</i>	51.80ab
<i>Cedrela odorata</i>	47.60ab
<i>Vigna unguiculata</i>	38.80b

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<i>Albizia lebbek</i>	51.20ab
<b>Control</b>	38.40a
<b>CV</b>	29.47

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**NOTE:** Means with the same letters are not significant different from each other at 5% level of probability

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# Fuel and Carbon Footprint: an Indian perspective

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## ABSTRACT

Since the past three decades, India has advanced rapidly in terms of industrialization and productivity and economic stability. However, this has come at the cost of dramatically increased fuel consumption. Burning of fossil fuels, which is the mainstay of our power generation, has caused an ever increasing carbon footprint in the face of the earth. Also, with the increased buying power, the consumption of the average citizen factored in, this is contributing to rapid accrued carbon debt. The increase in pollution cost India dearly in terms of money, productivity and mortality & morbidity. However, initiatives are being taken to mitigate these issues. In this article we report on the origin, effects and measures taken to mitigate the rising carbon footprint scenario in India.

**KEY WORDS:** Carbon footprint, fossil fuel, CO<sub>2</sub> emission, renewable energy,

## INTRODUCTION

In the period between 1994 and 2017, India's industrial production [1] has seen a steady growth of around 6.64%, reaching an all time high of 20% in november, 2006. Year on year, the industrial productivity increased by 2.7% in March 2017. Industrial production being a measure of the output of the businesses linked to industrial sector including manufacturing, mining, and utilities, is an indicator of the growing demand of commodities in this emerging nation. Since 1960, the GDP (Gross domestic product) has increased staggeringly from a record low of only USD 37.68 billion to USD 2088.80 billion in 2015. This represented 3.37% of the world economy [1]. In the future, substantive and sustained growth of both industry and living standard (hence economical) would entail an increase in power consumption, which could only be fulfilled (under current scenario) by increasing consumption of fossil fuels, since it is still the cheapest source of energy. With the rise of GDP had risen the purchasing power of average Indian. With more disposable income, the population is more likely to acquire and replace products more frequently. The domestic energy consumption had gone up substantially. The per capita electricity production in 2015-16 was provisionally estimated to be 1075 KWh. Although, this is much less compared to say China (4000 KWh) or the developed nation (average 15000 KWh), however with the initiative taken by the Government for rapid penetration of electric supply in rural India, this is set to increase further [2]. Coal accounts for nearly 50% of the total energy supply, followed by oil and gas. Renewable energy accounts for only 15% of the total energy supply. With a compounded annual growth rate of 6.7%, the energy demand of India is all set to rise to 14500 TWh per year by 2050 [3]. This could lead to substantial carbon footprint.

## FOSSIL FUEL CONSUMPTION AND CARBON FOOTPRINT OF INDIA

Carbon footprint refers to the amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organization, or community. According to the 2016 EDGAR (emission database for global atmospheric research) report compiled [4] by the European Commission and Netherland Environmental Assessment Agency; in 2015, India ranked 4th in the world for CO<sub>2</sub> emission. The estimated CO<sub>2</sub> emission was 2454968 Ktonne. This accounted for 6.81% of total CO<sub>2</sub> released to atmosphere. The top emitter in 2015 was China with 10,641,789 Ktonne CO<sub>2</sub> emission. This accounted for 29.51% of the global emission. For comparison, in 2010, India's CO<sub>2</sub> emission was 1848710 Ktonne. In 1990, it was only 649205 Ktonne. This represents an almost 280% increase in CO<sub>2</sub> emission by India in 25 years period. Year-on year, whereas the CO<sub>2</sub> emission (in 2015) decreased for China and United States, it increased for India by 5.1% (still less than the average growth rate of 6.8% annually between 2006-2015). In 2015, whereas the global primary energy consumption increased by 1%, the global coal consumption decreased by 1.8%. However, the coal consumption in India increased in 2015. Globally, coal combustion accounted for 46% of CO<sub>2</sub> emission, with 31% emitted from coal fired power plants. Coal fired power plants accounted for 47% of CO<sub>2</sub> emission in India. Also its worth noting that global oil consumption in 2015 increased by 1.9% which was mainly due to the increase in oil consumption by China, United States and India. Since 2010, a total of 473.4 TW coal fires power plant had been added across 33 countries. Out of that, India account for 102 TW [5]. China figures higher at 208 TW. But, interestingly, India is still one of the lowest emitter of CO<sub>2</sub>. The 2016 EDGAR report suggests that the per capita CO<sub>2</sub> emission in India was 1.9 tonne/cap per year whereas the global annual average was 4.9 tonne/cap.

However, with the current capacity for growth in emission, India could surpass the EU by 2020, thereby leaving a larger carbon footprint. An analysis of the emission data in the regards to India suggest that the increase in CO<sub>2</sub> emission is directly coupled with her GDP growth. Whereas the GDP grew at a rate of 7.4% (2006-2015), CO<sub>2</sub> emission also grew annually by about 6.8%. This is directly linked with the growing domestic demand. In 2015, the total energy consumption in India went up by 5.1%. This was mitigated by an increase in supply of fossil fuel (coal by 4.8% and oil consumption by 8.1%). Between 1990 and first half of 2016, India added a total of about 165 GW of coal power capacity. Currently, 64.7 GW is under construction and a further permitted capacity of 178.2 GW is in the pipeline. The coal production in India increased by 7%, however, this does not meet India's gross coal demand. In 2015, India was the third largest energy consumer in the world. Oil and natural gas accounted for 37% of her total energy needs. India is among the largest consumer of petrol globally. In 2015, India was the 3rd largest consumer of crude oil and petroleum products in the world after USA and China. Although, the import of oil declined by 10% y-o-y (year on year) in the first quarter of 2017, the domestic oil consumption increased by 10.7%, which is a 16 year high of 196.48 MT in 2016. In the fiscal year 2016, oil production in India reached 36.942 MMT, whereas in 2015, it was 37.461 MMT. The net import of crude oil rose from 111.50 MT during 2006-07 to 202.85 MT during 2015-16. According to estimates by OPEC, the demand for oil in 2017 would be 1.26 mb/d, the majority of which will be consumed by India followed by China. India's oil demand is expected to grow at a CAGR (compound annual growth rate) of 3.6% to a staggering 458 MT of Oil Equivalent. India is the 4th largest consumer of LNG (liquefied natural gas), and account for 5.8% of the total trade globally. The internal LNG demand in India is expected to grow at a CAGR of 16.89% to 306.54 MMSCMD by 2021. It was 64 MMSCMD in 2015. India's domestic gas production in 2016-17 was 23.09 BCM, which is also expected to raise to 90 BCM by 2040 [6]. Due to various hurdles in procurement and deployment of other fossil fuels, promote clean energy for the nation and keeping in mind the cost factor, various core sectors including transport, power generation, petrochemical production and fertilizer are shifting rapidly towards natural gas (LNG). This is leading to exponentiated demand for natural gas. This huge increase in demand for fossil fuels in India for industrial, transportation and domestic purpose will lead to large increase in CO<sub>2</sub> emission in the atmosphere.

## MITIGATION

In order to mitigate the growing crisis of fast depleting natural resources and degradation of the environment, the Government of India has taken various initiatives including introduction of nuclear power, encouraging increase of share of renewable energy in our energy mix and refinement of fuel standard (for oil and LNG) required for transportation and other industries.

The demand for electricity in India is rising at a very fast pace, both for domestic purpose and industrial sector. Currently, India is the world's 3<sup>rd</sup> largest producer and 4<sup>th</sup> largest consumer of electricity. At 1287 TWh, the electricity produced in 2014 was triple of what was produced back in 1990. With about 19.4% transmission loss, this amounted to a consumption of about 947 TWh in 2014. In the fiscal year 2015-16, the total electricity generation was 1352 TWh or 1075.64 kWh/capita. From the available statistics, the gross electricity generation in 2014 comprised of 850 TWh from black coal, 36 TWh from brown coal, 63 TWh from gas, 23 TWh from oil. These are all fossil fuel generated power. Renewable energy resources accounted for about 199 TWh of electricity generation. More than three quarter of the power in the recent years is being generated from coal, which is leading to lot of pollution. The per capita electricity consumption figures are estimated to double by 2020 and reach 5000-6000 kWh/year by 2050. Hence there is an urgent demand for reliable and viable energy source to meet this increasing power load. The nuclear power roadmap was envisioned to fulfill this goal. Since its inception in 1987, NPCIL (Nuclear Power Corporation of India Limited) has been making slow but steady progress in fulfilling the energy gap, given its severe constraint in procurement of nuclear fuel. As of March 01, 2017, the total installed nuclear electricity generation capacity is 6.78 GW. This accounts for only 1.91% of the total installed capacity. NPCIL aims to produce 20 GW energy by 2020 and then more than triple (63 GW) its load capacity by 2032. The nuclear power generation in India has received the ISO-14001 accreditation for environmental management system and peer review by World Association of Nuclear Operators. As of 2016, India has 22 nuclear reactors in operation in 8 nuclear power plants across India. The total installed capacity is 6780 MW and the producing a total of 30,292.91 GWh of electricity. 6 more reactors are under construction and is expected to be operational with an added 4,300 MW capacity. India is taking active initiative in funding cold fusion research and is also a part of the ITER megaproject. Indian Government is also developing upto 62 thorium based reactors, which is expected to be operational by 2025. The advances in the field of working, designing and prototyping of the thorium and low enricher uranium -based fuel reactors are all part of India's three stage nuclear power programme [7]. Currently, the renewable energy resources in India contribute around 30% of the primary energy. India was the first country in the world to set up a ministry of non-conventional energy in early 1980s [8]. As of September 2016, the grid connected renewable energy capacity was about 50.2 GW. Of this, 61% contribution came from wind energy whereas solar energy contributed around 19%. Third came biogas with about 16% contribution, small hydro around 8.5% and waste to power about 0.2%. As of February 2017, the total installed

large hydropower capacity is around 44.41 GW. It is worth mentioning here that India has the fourth largest installed wind power capacity in the world. As of February 28, 2017, the total installed wind power capacity in India is 29151.29 MW. In the case of solar power, the main impetus at the beginning had been to apply it for water pumping in remote places and off-grid lighting. However, with the advent of better technology and through various government projects, solar power in India has been growing at a fast pace of 113% yoy and the current unit cost of solar power has dropped to 4.34 INR (Indian Rupees). India also ranks seventh in the world for hydroelectricity generation. As of March 2016, the total grid utility installed capacity of hydroelectricity is 42,783 MW. India has set a goal to more than double the wind power capacity and increase the solar power capacity by fifteen times of the April 2016 level by 2022. India is a part of the International Solar Alliance, and achievement of such ambitious projection would put her firmly in a leading position across the world. India intends to generate as much as 40% of the total installed capacity from non-fossil based fuel by 2030. By 2021, the Ministry for Energy aims to increase the total renewable energy capacity by 175 GW, with 100 GW of solar power and 60 GW of wind power, and also reduce the grid transmission losses to 15% by 2019 [8]. These initiatives would greatly reduce the emission of green house gases in the future. Since 1991, the government has been setting progressively stricter norms of fuel emission starting from BS-I (Bharat Stage I) and BS-II introduced in April 1999. Following the Auto Emission Policy 2003, the BS-III was introduced in April 2005 in 13 major cities. Keeping ahead of schedule, BS-IV has also been implemented as of April 2016. Keeping in lieu with the developments, the oil firms in India are also gearing up to embrace the refined oil to keep in check auto emission. Also introduction of CNG for running of public and private vehicles have also cut down the emission by a large amount [9].

## CONCLUSION

With the sustained effort of the government in implementing protocols for transition to low carbon economy and through active participation of the top listed companies in reducing emission, India can seriously assert her role in reducing the carbon footprint and embarking upon an era of responsible, sustainable development. However, the challenge lie in implementing (with utmost transparency) these initiatives through active participation of all stakeholders.

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# Workplace Spirituality, Glass Ceiling Beliefs and Subjective Success

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**Abstract-** There is a growing interest in the field of workplace spirituality and glass ceiling. Till date, no research has explored the connection between the two topics. In this paper, the relation between workplace spirituality and glass ceiling beliefs is described. In addition, the mediating role of glass ceiling beliefs in the relationship between workplace spirituality and subjective success which has emerged to be one of the most important organizational outcomes has also been proposed. First, a model of workplace spirituality and glass ceiling beliefs is presented in which three dimensions of workplace spirituality (community, meaningful work and inner life) relate to the glass ceiling through four beliefs (acceptance, resignation, denial and resilience). Second, a mediation model of glass ceiling beliefs in the relationship between workplace spirituality and subjective success (career satisfaction, work engagement, physical & psychological well-being and job happiness) is presented. The paper concludes with a discussion of the theoretical and practical implications of the proposed models.

**Index Terms-** Workplace spirituality, Glass ceiling beliefs, Subjective success, Women

## I. INTRODUCTION

Workplace spirituality is the latest trend in management (Miller, 1998; Wagner-Marsh and Conley, 1999; Shellenbarger, 2000; Krebs, 2001; Brown, 2003; Kale and Shrivastava, 2003; Milliman et al., 2003; Wong, 2003; Carrette and King, 2005; Gogoi, 2005; Singhal and Chatterjee, 2006; Case and Gosling, 2010; Giacalone and Jurkiewicz, 2010; Pfeffer, 2010). Numerous researchers claim that workplace spirituality is difficult to define (Laabs, 1995; Leigh, 1997; Brenda Freshman, 1999; Krishnakumar and Neck, 2002; Mitroff, 2003; Singhal and Chatterjee, 2006; Oswick, 2009; Giacalone and Jurkiewicz, 2010). There are more than seventy definitions of workplace spirituality and yet none is universally accepted (Markow and Klenke, 2005; Gotsis and Kortezi, 2008; Karakas, 2010).

Today's organizations suffer from spiritual impoverishment (Mitroff and Denton, 1999). Numerous changes in the work environment have instilled insecurity, fear, uncertainty and chaos in minds of employees (Harman, 1992; Cacioppe, 2000; Kennedy, 2001). Corporate crimes, ethical scandals, downsizing, financial crises, economic recession and competition have polluted the organizational climate (Biberman and Whitty, 1997; Cacioppe, 2000; Neal, 2000; Giacalone and Jurkiewicz, 2003a; 2003b). As a result, employees feel cynical, distanced and vulnerable. Employees these days are lost and insecure due to inner spiritual shortage (Gawain, 2000). Workaholism has become a serious and growing problem for all employees across the world (Gini, 1998; Rifkin, 2004). This leads to stress and loss of spirituality, illnesses, fatigue, fear and guilt (Killinger, 2006). Increasing stress leads to higher absenteeism and lower productivity (Cartwright and Cooper, 1997). Most employees experience overwork in their workplaces (Galinsky et al., 2005). Hard work and long hours can be unhealthy for employees as they pursue external rewards rather than inner peace (Burke, 2006). There is unfriendly environment with people acting artificial, playing down others and putting on masks (Neal, 1999). Downsizing has reduced the morale and commitment of employees (Brandt, 1996; Duxbury and Higgins, 2002; Giacalone and Jurkiewicz, 2003a; 2003b). Employees feel lost, disengaged, unappreciated and insecure in the workplaces (Meyer and Allen, 1997; Sparrow and Cooper, 2003). Apart from this, executives report unhappiness, dissatisfaction (Barrett, 2004), psychological isolation and alienation (Harman, 1992; Bolman and Deal, 1995; Cavanagh, 1999), vacuum and a lack of meaning in their work lives (Dehler and Welsh, 1994; Cavanagh, 1999; Pratt and Ashforth, 2003) and there is decline of respect, trust and confidence in management (Shaw, 1997; Burack, 1999). Employees feel a need for spiritual connection due to the changing organizational structure and uncertainties in the workplace (Harrington et al., 2001; Giacalone and Jurkiewicz, 2003a, 2003b). Gull and Doh (2004) observed that where spirituality is absent, there is a lack of understanding that we are deeply connected.

This explains why a growing number of managers and employees are resorting to meditation, reflection, spiritual practices and sports exercises (Dehler and Welsh, 1994; Cartwright and Cooper, 1997). Spirituality could increase employees' morale, commitment, well-being and productivity (Krishnakumar and Neck, 2002; Karakas, 2010) and reduce their stress. Aburdene (2005) observed that seekers turn to the spiritual path for anything and everything. Neal, Lichtenstein and Banner (1999) suggested that spirituality will allow people to loosen their grip on reality and let societal transformation and paradigm shift to occur.

Workplace spirituality research is in its early stage (Dent et al., 2005; Duchon and Plowman, 2005; Sheep, 2006). Most of the workplace spirituality literature is individualistic and does not focus on broader social concerns (Mitroff and Denton, 1999). Researchers have noted that empirical research on the effects of workplace spirituality on organizational outcomes is inadequately examined (Milliman et al., 2003; Duchon and Plowman, 2005) and lacks rigor and thinking (Gibbons, 2000). The studies that have dealt with the effect of workplace spirituality on employee attitudes often assume that it would always be positive (Gibbons, 2000) without statistical analysis.

Since the 1980's, numerous researchers have documented the glass ceiling phenomenon in major employment sectors. Working women are struggling with work-life balance, stress, harassment, unfair treatment, discrimination and insecurity in the workplace (Manisha and Singh, 2016). Women's failure in reaching the top management level is being attributed to the 'glass ceiling' which is a metaphor that describes the obstacles and hurdles that prevents women's ascent. Women are unaware of the glass ceiling when they enter but as they climb, it suddenly becomes apparent and blocks their upward movement. Numerous studies have validated the existence of a glass ceiling and several studies have qualitatively examined it. There is a dearth of studies that have explored the antecedents and outcomes of women's attitudes towards the glass ceilings in organizations.

Given the importance of women in the workforce, combined with the increasing disconnection employees feel with their inner selves and the growing difficulties women face in the workplace, a key concern for most organizations these days is to promote women's contribution in the workplace.

#### *Research Questions*

1. Does workplace spirituality predict glass ceiling beliefs?
2. Do glass ceiling beliefs mediate the relation between workplace spirituality and subjective success?

## II. WORKPLACE SPIRITUALITY

Neck and Milliman (1994) defined workplace spirituality as "expressing a desire to find meaning and purpose in life," "a transcendent personal state," "living by inner truth to produce positive attitudes and relationships," and "a belief of being connected to each other and desire to go beyond one's self-interest to contribute to society as a whole."

Ashmos and Duchon (2000) described workplace spirituality as "a recognition that employees have an inner life which nourishes and is nourished by meaningful work, taking place in the context of a community."

Grzeda and Assogbavi (2011) suggested that workplace spirituality consists of those management behaviors driven entirely by spiritual values, teachings, or beliefs, regardless of their source, creating connections between behavior and personal spiritual meanings which are cognitively acknowledged and affectively valued by the manager.

Ashmos and Duchon (2000), operationalized three dimensions of workplace spirituality at the individual level, which are essentially employee perceptions of various aspects of an organization (Duchon and Plowman, 2005) namely, meaningful work, community and inner life.

- 1) Community or connectedness occurs at the group level of human behaviour and is based on the belief that people see themselves as connected to each other. Community is a place where people can experience personal growth, are valued and have a sense of working together. It refers to the extent to which employees feel being a part of their work community where they "can experience personal growth, be valued for themselves as individuals, and have a sense of working together". It involves a deeper sense of connection among people, including support, freedom of expression (Mitroff and Denton 1999) and represents the fellowship dimension of spirituality (Vaill, 1998).
- 2) Meaningful work is a work-related dimension of human experience that occurs at the individual level of human behaviour and is based on the belief that each person has his/her own inner motivations and truths and desires to be involved in activities that give greater meaning to his/her life and the lives of others (Hawley, 1993; Ashmos and Duchon, 2000). This refers to "a sense of what is important, energizing, and joyful about work".
- 3) Inner life occurs at the individual level of human behaviour and reflects an individuals' hopefulness, awareness of personal values and concern for spirituality.

Apart from inner life, some researchers have operationalized positive organizational purpose as the third dimension of workplace spirituality. Positive organizational purpose refers to the extent to which employees perceive their organization as having a positive purpose in relation to employees, society, etc.

Milliman, Czaplewski, and Ferguson (2003) and Kinjerski and Skrypnek (2004) argued that workplace spirituality should involve three levels: individual, group, and organizational, and the dimensions representing these three levels are meaningful work, shared feelings in work communities and alignment with organizational values instead of inner life.

- 1) Meaningful work. This refers to the individuals' in-depth feelings toward work meaning and purpose and connection between work and the meaning of life.
- 2) Shared feelings in work communities. This refers to interpersonal and profound connections and relationships. This means that work relationships are based on trust, support, communication and employees support each other as families (Brown, 2003).
- 3) Alignment with organizational values. This is the organizational level of workplace spirituality. Individuals would experience powerful feeling from alignment with organizational missions or values. This means that the organizational values would enhance the workplace spirituality of employees (Brown, 2003). When organizational values encourage the employees to contribute, help the society or work towards the larger good, the employees' workplace spirituality is enhanced (Ashmos & Duchon, 2000).

Petchsawanga and Duchon (2009) observed that in an asian context, four themes namely, compassion, mindfulness, meaningful work and transcendence define workplace spirituality.

- 1) Compassion refers to deep awareness of and sympathy for others (Twigg and Parayitam, 2006) and desire to relieve others' sufferings (Farlex, 2007).
- 2) Mindfulness is defined as a state of inner consciousness in which one is aware of one's thoughts and actions moment by moment.
- 3) Meaningful work is defined as one's experience that his/her work is a significant and meaningful part of his/her life (Duchon and Plowman 2005).
- 4) Transcendence is a mystical experience dimension described as "a positive state of energy or vitality, a sense of perfection, transcendence, and experiences of joy and bliss" (Kinjerski and Skrypnek, 2006).

Ashforth and Pratt (2010) suggested that spirituality at work has three major dimensions: transcendence of self, holism and harmony, and growth.

- 1) Transcendence of self involves a connection to something greater than oneself and an expansion of one's boundaries to encompass other people and things.
- 2) Holism means the integration of the various aspects of oneself, while harmony is the sense that this integration is synergistic and informs one's behavior.
- 3) Growth refers to self-development and self-actualization and the realization of one's aspirations and potential.

The present study considers the individual workplace spirituality dimensions of community, meaningful work and inner life. Inner life is a holistic dimension because it is an integration of personal identity and work role identity (Prabhu, Rodrigues and Kumar, 2017). Sheep (2006) observed that human beings become complete when they can fully express their 'self'.

### III. GLASS CEILING BELIEFS

The metaphor 'glass ceiling' refers to the underrepresentation of women in top positions in organizations. In other words, it is the barrier women face when climbing the organizational ladder. The term 'glass ceiling' was coined by Hymowitz and Schellhardt (1986) in the Wall Street Journal. The glass ceiling is invisible to women from the bottom when they start their careers but later stops them from attaining equality with men (Morrison et al., 1987). The phenomenon is called 'ceiling' as there is an obstacle to upward advancement and 'glass' because these obstacles are not immediately apparent and are an unwritten and unofficial policy. Although women are able to get through the front door of managerial hierarchies, at some point they hit an invisible barrier that blocks any further upward movement. The glass ceiling hypothesis suggests that obstacles to promotion increase for both men and women as they move up the management level, but the barriers intensify more for women than for men (Baxter and Wright, 2000).

Jackson, O'Callaghan and Leon (2014) described the glass ceiling as unique form of discrimination characterized by gender or racial inequalities that are not explained by other job-relevant characteristics of the employee.

There are several qualitative studies on glass ceiling based on in-depth interviews (Morrison, White and Van Velsor, 1992; Ragins, Townsend and Mattis, 1998; Goward, 2001; Wrigley, 2002; Marthur-Helm, 2006; Stone, 2007; Kumra and Vinnicombe, 2008, Murniati, 2012). Some researchers have quantitatively studied the glass ceiling (Terborg et al., 1977; Dubno et al., 1979; Lyness and Thompson, 1997; Jackson, 2001; Wood and Lindorff, 2001; Bergman, 2003 and Elacqua et al., 2009).

There is ample evidence that glass ceiling exists for women employees in nearly all sectors and regions (Weyer, 2007).

Smith (2012) using the role congruity theory of prejudice against female leaders (Eagly and Karau, 2002) and Wrigley's (2002) concepts of denial, negotiated resignation and acceptance, developed the career pathways survey. The career pathways survey has been designed for women at all management levels. The CPS measures the four glass ceiling beliefs namely, acceptance, resignation, denial and resilience.

#### *A. Acceptance*

Acceptance is the belief that women prefer other life goals such as family involvement than developing a career. It explains why women are satisfied and don't seek promotions. Acceptance is pro-family/anti-career advancement set of beliefs. It depicts women's pessimism regarding promotions due to which they stop making efforts towards top positions.

#### *B. Resignation*

Resignation is the negative belief that women suffer many more negative consequences than men when seeking career advancement. It explains why women give up and withdraw from the workplace due to social and organizational obstacles. It depicts women's dissatisfaction with their careers eventually leading to disinterest.

#### *C. Denial*

Denial is the belief that men and women face the same issues and problems in seeking leadership. It shows why women believe that glass ceilings don't exist. Denial stems from optimism and depicts high satisfaction and interest in pursuing career advancement.

#### *D. Resilience*

Resilience is the belief that women are able to overcome barriers and break glass ceilings. It shows that women feel they have the potential to move forward in their careers. This is an optimistic belief that explains why women after acknowledging the existence of gender barriers, work hard to attain promotions and equal footing with men.

### IV. SUBJECTIVE SUCCESS

Subjective or intrinsic success refers to the success as sensed, perceived or felt by the individual oneself. It is measured through the beliefs, opinions, emotions or feelings of the individual and not through facts. Subjective career success refers to all aspects relevant concerning one's individual career satisfaction (Greenhaus, Parasuraman and Wormley, 1990). Seibert and Kraimer (2001) define subjective success as an individual's subjective evaluation of the present achievements compared to his personal goals and expectations. Researchers have recommended further studies on subjective success for organizational benefits (Lyubomirsky et al., 2005; Fisher, 2010).

This study used four important indicators of subjective success namely, career satisfaction (Judge, Cable, Boudreau, and Bretz, 1995; Boudreau, Boswell, and Judge, 2001; Ng, Eby, Sorenson and Feldman, 2005; Judge and Hurst, 2008; Abele, Spurk, and Volmer, 2011), work engagement, physical well-being, psychological well-being and job happiness (Carr, 1997; Clark, 1997; Armstrong-Stassen and Cameron, 2005; Burke, Burgess and Fallon, 2006; Orser and Leck, 2010). In the present study, the terms psychological well-being and emotional well-being have been used interchangeably. Also, the terms, work engagement and employee engagement, career satisfaction and job satisfaction have been used interchangeably.

#### *A. Career Satisfaction*

Career satisfaction is the satisfaction that individuals derive from the intrinsic and extrinsic aspects of their careers, including pay, advancement and developmental opportunities (Greenhaus, Parasuraman, & Wormley, 1990). Jen-Ruei Fu (2010) defined career satisfaction as the level of overall happiness experienced through one's choice of career.

Job satisfaction is confined to the present job (Heslin, 2005) and might be an inadequate measure of career success because subjective success indicates satisfaction over a longer time frame and wider range of outcomes. Although both job satisfaction and career satisfaction are indicators of subjective success, the latter is more appropriate.

### *B. Work Engagement*

Schaufeli et al. (2002) defined work engagement as a positive, fulfilling state of mind that is characterized by vigor, dedication and absorption.

- 1) Vigor is characterized by high levels of energy and mental resilience while working, the willingness to invest effort in one's work and persistence even in the face of difficulties. Shirom (2003) defined it as employees' physical strength, emotional energy and cognitive liveliness.
- 2) Dedication refers to being strongly involved in one's work and experiencing a sense of significance, enthusiasm, inspiration, pride and challenge.
- 3) Absorption is characterized by being fully concentrated and happily engrossed in one's work, whereby time passes quickly and one has difficulties with detaching oneself from work.

May, Gilson and Harter (2004) operationalized a three-dimensional concept of engagement having a physical, emotional and cognitive component. Harter, Schmidt and Hayes (2002) describe engagement in terms of cognitive vigilance and emotional connectedness. They suggest that engaged workers know what is expected of them, have what they need to do their work, have opportunities to feel an impact and fulfilment in their work, perceive that they are part of something significant with co-workers they trust, and have chances to improve and develop.

### *C. Physical & Psychological Well-Being*

Physical well-being relates to the lack of illnesses (Ware et al., 1996). Psychological well-being is a state of well-being in which the individual realizes his or her own abilities, can cope with normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community (Centre for Disease Control, 2011).

### *D. Job Happiness*

There is no clear consensus on what "happiness" means. Lyubomirsky, King and Deiner (2005) described happiness as the experience of joy, contentment, or positive well-being, combined with a sense that one's life is good, meaningful and worthwhile. Diener and Biswas-Diener (2008) defined happiness as subjective well-being, which involves both positive and negative affect with cognitive influences. Subjective well-being comprises happiness and life satisfaction. Thus, happiness is a narrower concept than subjective well-being (Bruni and Porta, 2007). Economists use the terms "happiness" and "life satisfaction" interchangeably as measures of subjective wellbeing (Easterlin, 2004).

Job happiness is a positive concept which results in a better work relationship among employees in a work environment (Bagheri, Akbari and Hatami, 2011). Subjective well-being is the scientific term for happiness (Diener, Lucas and Oishi, 2002; Veenhoven 2012) and is the label given to various forms of happiness taken together. Happiness involves three components: the amount of positive affect or joy, a satisfaction rating over a period, and the lack of negative affect or depression and anxiety (Argyle and Lu, 1990).

## V. WORKPLACE SPIRITUALITY AND SUBJECTIVE SUCCESS

Numerous studies have validated the relation between workplace spirituality and subjective success indicators. The most relevant literature has been provided below.

### *A. Workplace Spirituality and Career Satisfaction*

Some researchers had suggested a relationship between workplace spirituality and work satisfaction (Neck and Milliman, 1994; Turner, 1999; Ashmos and Duchon, 2000; Krishnakumar and Neck, 2002). Milliman, Czaplewski and Ferguson (2003) hypothesized a relationship of workplace spirituality with five important job attitudes including intrinsic work satisfaction. In this study, workplace spirituality at organizational level comprising meaningful work, sense of community and alignment with organizational values was measured using spirituality at work scale (SAWS; Ashmos and Duchon, 2000). Intrinsic work satisfaction was measured by the scale based on motivation hygiene theory (Herzberg et al; 1959). Structural equation modelling showed that all three dimensions of workplace spirituality were significantly correlated with five employee job attitudes variables. Thus, it was concluded that workplace spirituality

enhances intrinsic work satisfaction. Numerous researchers have validated this theory empirically (Fairbrother and Warn, 2003; Giacalone and Jurkiewicz, 2003a, 2003b; Nur and Organ, 2006; Robert et al. 2006; Clark et al. 2007, Chawla and Guda, 2010, Usman and Danish, 2010; Altaf and Awan, 2011, Bodia and Ali, 2012, Gupta et al., 2013; Hassan, Nadeem and Akhter, 2016). Several studies using the workplace spirituality at personal level dimensions of community, meaningful work and inner life have arrived at the same conclusion.

### *B. Workplace Spirituality and Work Engagement*

Previous research had suggested a relationship between workplace spirituality and engagement (Mirvis, 1997; Kinjerski and Skrypnek, 2004; Kolodinsky et al., 2008; Giacalone and Jurkiewicz, 2010). The model proposed by Saks (2011) suggests that workplace spirituality is directly related to employee engagement and indirectly related to employee engagement through Kahn's (1990) three psychological conditions (i.e. meaningfulness, availability, and safety) for employee engagement. Three dimensions of workplace spirituality namely, transcendence, sense of community, and spiritual values have been shown in the model (Ashmos and Duchon 2000; Milliman et al. 2003; Jurkiewicz and Giacalone 2004; Ashforth and Pratt 2010). The theory has been validated by several researchers (Catwright and Holmes, 2006; Bakker and Demerouti, 2008). The model holds for the workplace spirituality dimensions proposed by Ashmos and Duchon (2000) (Devi, 2016) and Kinjerski and Skrypnek (2006) (Danish et al., 2014).

### *C. Workplace Spirituality and Employee Well-being*

There is ample evidence for the link between spiritual well-being and physical & psychological well-being (Udermann, 1999; Mackenzie et al., 2000; Calicchia and Graham, 2006; Lustyk et al., 2006). Also, spirituality leads to subjective well-being or happiness (Emmons, 1999; Caras, 2003; Giacalone and Jurkiewicz, 2003a, 2003b; Sreekumar, 2008; Marlin, 2009; Walker, 2009).

Hettler (1977) proposed a six-dimensional model of employee wellness with spiritual well-being as one of the main components. This shows that spirituality is an integral part of one's holistic health. Spirituality enhances employee well-being (Giacalone and Jurkiewicz, 2003a; 2003b) thereby leading to higher organizational performance (Neck and Milliman, 1994; Reave, 2005). Stress, workaholism and overwork results in loss of spirituality, fatigue, illness, fear and guilt (Killinger, 2006). As a result, many employees are resorting to spiritual practices to cope with stressors at work (Cartwright and Cooper, 1997).

Based on these suggestions, Karakas (2010) proposed that incorporating spirituality at work increases employees' well-being by increasing their morale, commitment, and productivity and decreases employees' stress, burnout, and workaholism in the workplace. This theory has been validated by several researchers (Marschke et al., 2011; Lun and Bond, 2013; Kumar and Kumar, 2014; Pawar, 2016; Yaghoubi and Motahhari, 2016; Khatri and Gupta, 2017).

## VI. GLASS CEILING BELIEFS AND SUBJECTIVE SUCCESS

Smith (2012) using snowball sampling collected data from 258 women executives serving in different organizations in Australia. Glass ceiling beliefs namely, acceptance, resignation, denial and resilience were measured using the 38-item career pathways survey (CPS; Smith et al., 2012). Correlation and regression analysis was performed using SPSS. The results are summarized in following sections.

### *A. Glass Ceiling Beliefs and Career Satisfaction*

Career satisfaction was measured using the career satisfaction scale (Greenhaus et al., 1990). Correlation analysis revealed a significant association between resignation ( $r = -0.13$ ,  $p < 0.01$ ), denial ( $r = 0.27$ ,  $p < 0.01$ ) and resilience ( $r = 0.14$ ,  $p < 0.05$ ). Acceptance did not show significant relationship with career satisfaction. Regression analysis showed a significant effect of denial on career satisfaction ( $\beta = 0.30$ ,  $p < 0.001$ ). The glass ceiling beliefs predicted 17% variance in career satisfaction.

### *B. Glass Ceiling Beliefs and Work Engagement*

The 9-item Utrecht work engagement scale (UWES-9; Schaufeli, Bakker and Salanova, 2006) was used to measure work engagement. Results revealed a significant association of work engagement with denial ( $r = 0.15$ ,  $p < 0.05$ ) and resilience ( $r = 0.14$ ,  $p < 0.05$ ). Acceptance and resignation were not found to be significantly associated with work engagement. Regression analysis showed acceptance ( $\beta = -0.16$ ,  $p < 0.05$ ), denial ( $\beta = 0.19$ ,  $p < 0.01$ ) and resilience ( $\beta = 0.15$ ,  $p < 0.05$ ) significantly predicted work engagement. The overall effect of glass ceiling beliefs on work engagement was significant ( $R^2 = 0.12$ ,  $p < 0.01$ ).

### *C. Glass Ceiling Beliefs and Physical & Psychological Well-Being*

Physical and psychological well-being was measured using 6 items from the SF-12 Health Survey (Ware et al., 1996.1). Resignation was found to be negatively related to physical well-being ( $r = -0.16$ ,  $p < 0.05$ ) and psychological well-being ( $r = -0.27$ ,  $p < 0.01$ ). Denial

was positively associated with psychological well-being ( $r = 0.18, p < 0.05$ ) but not with physical well-being. Acceptance and resilience were not significantly associated with physical and psychological well-being. Resignation significantly predicted physical well-being ( $\beta = -0.21, p < 0.01$ ) and psychological well-being ( $\beta = -0.25, p < 0.01$ ). The glass ceiling beliefs predicted 7% variance in physical well-being and 10% variance in psychological well-being.

#### D. Glass Ceiling Beliefs and Job Happiness

The 4-item subjective happiness scale (Lyubomirsky and Lepper, 1999) was used to measure job happiness. Denial ( $r = 0.19, p < 0.01$ ) and resignation ( $r = -0.20, p < 0.01$ ) were significantly related to job happiness. Acceptance and resilience were not found to be related to job happiness. Resilience ( $\beta = 0.14, p < 0.05$ ) and resignation ( $\beta = -0.17, p < 0.05$ ) significantly predicted job happiness. The glass ceiling beliefs predicted 10% variance in job happiness.

### VII. WORKPLACE SPIRITUALITY AND GLASS CEILING BELIEFS

Although workplace spirituality and glass ceiling beliefs are independent topics, a careful review of the definitions and dimensions suggest that they are connected. The theoretical framework of the connection is based on optimism theory (Scheier and Carver, 1992). Dispositional optimism is a stable expectancy that good things will happen in life (Scheier and Carver, 1992). Workplace spirituality, resilience and denial are positive psychological constructs while acceptance and resignation are negative psychological constructs. Acceptance and resignation are negative beliefs and denial and resilience are positive beliefs about the glass ceiling. Optimism is associated with acceptance and resilience while pessimism is positively associated with resilience (Scheier and Carver, 1992). Psychological capital (Luthans et al., 2004) is a positive psychological construct comprising hope, self-efficacy, resilience and optimism. Luthans, Youssef and Avolio (2007) defined psychological capital as “an individual’s positive psychological state of development that is characterized by: having confidence (self-efficacy) to take on and put in the necessary effort to succeed at challenging tasks; making a positive attribution (optimism) about succeeding now and in the future; persevering toward goals, and when necessary, redirecting paths to goals (hope) in order to succeed; and when beset by problems and adversity, sustaining and bouncing back and even beyond (resilience) to attain success”. Emmons (1999) suggested that spirituality enhances self-esteem, hope and optimism. Workplace spirituality is positively related to psychological capital dimensions of hope, self-efficacy, resilience and optimism (Jena and Pradhan, 2015). This suggests that workplace spirituality is an antecedent of optimism which leads women to believe that glass ceilings do not exist or can be broken. On the other hand, a lack of individual spirituality could result in low self-esteem and pessimism leading one to believe that it is difficult or futile to break glass ceilings. Therefore, workplace spirituality is associated with acceptance, resignation, denial and resilience as depicted in Figure 1.1.

Figure 1.1 Proposed model of workplace spirituality and glass ceiling beliefs



Individual spirituality dimensions of community, meaningful work and inner life were used as measures of workplace spirituality as it was important to study the inner self of the women managers that formed their beliefs.

*Proposition 1: Workplace spirituality (community, meaningful work and inner life) will be negatively related to acceptance*

*Proposition 2: Workplace spirituality (community, meaningful work and inner life) will be negatively related to resignation*

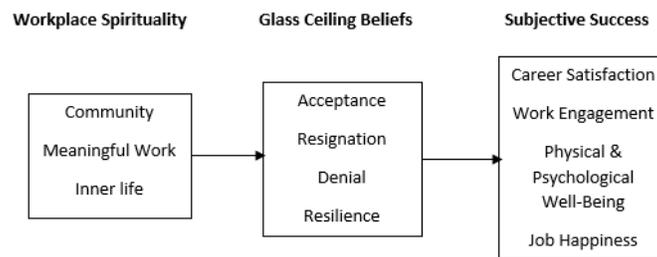
*Proposition 3: Workplace spirituality (community, meaningful work and inner life) will be positively related to denial*

*Proposition 4: Workplace spirituality (community, meaningful work and inner life) will be positively related to resilience*

### VIII. WORKPLACE SPIRITUALITY, GLASS CEILING BELIEFS AND SUBJECTIVE SUCCESS

Workplace spirituality is positively associated with subjective success indicators, career satisfaction (Milliman et al., 2003), work engagement (Saks, 2011), physical & psychological well-being and job happiness (Karakas, 2010). Glass ceiling beliefs namely, acceptance, resignation, denial and resilience are related to the subjective success indicators (Smith, 2012). As per the arguments laid in the previous section, workplace spirituality is an antecedent to glass ceiling beliefs. Glass ceiling beliefs are an antecedent to subjective success indicators. Therefore, it is possible that the effect of workplace spirituality on subjective success is mediated by glass ceiling beliefs. Figure 1.2 depicts the proposed model showing glass ceiling beliefs as mediator between workplace spirituality and subjective success.

Figure 1.2 Proposed model depicting mediating effect of glass ceiling beliefs on the relationship between workplace spirituality and subjective success



*Proposition 5: Acceptance mediates the relationship between workplace spirituality and subjective success*

*Proposition 6: Resignation mediates the relationship between workplace spirituality and subjective success*

*Proposition 7: Denial mediates the relationship between workplace spirituality and subjective success*

*Proposition 8: Resilience mediates the relationship between workplace spirituality and subjective success*

## IX. IMPLICATIONS FOR RESEARCH

The model of workplace spirituality and glass ceiling beliefs provides numerous directions for further research. Firstly, glass ceiling beliefs could be considered as an outcome of workplace spirituality among women. Secondly, future research could incorporate other dimensions of workplace spirituality such as transcendence, mindfulness, positive organizational purpose or alignment with organizational values. Thirdly, measures for glass ceiling could be developed that explore other beliefs apart from the ones described in the career pathways survey (Smith, Crittenden and Caputi, 2012). Also, researchers can use existing scales that measure perceptions, attitudes and opinions among women regarding the glass ceiling to test the model.

The mediation model of glass ceiling beliefs in the relationship between workplace spirituality and subjective success offers numerous avenues for researchers. Glass ceiling beliefs could be considered as an antecedent of subjective success indicators such as sense of identity (Law, Meijers and Wijers, 2002), organizational identification (Hall, 1976; Judge, Cable, Boudreau and Bretz, 1995), work-life balance (Finegold and Mohrman, 2001), self-worth, pride in achievement, fulfilling relationships, job commitment etc. (Nicholson and Waal-Andrews, 2005). Finally, experimental research could test the workplace spirituality interventions for improving glass ceiling beliefs and subjective success among working women.

## X. IMPLICATIONS FOR PRACTICE

The model of workplace spirituality, glass ceiling beliefs and subjective success proposed in the paper offer a new approach for improving glass ceiling beliefs and subjective success among working women. Organizations could learn from spiritual organizations that promote values such as trust, faith, respect, justice, conscientiousness etc. Programmes could be designed that help to enhance women's individual spirituality such as inner life, meaningful work, sense of community. Group meditation sessions could help to bring about an atmosphere of togetherness and brotherhood in the organization. Also, it could alleviate the tendency to compete and replace it with mutual respect and cooperation.

In summary, organizations looking to improve the self-esteem, glass ceiling beliefs and subjective success among women must understand the potential of workplace spirituality. Lastly, there may be numerous predictors of glass ceiling beliefs and subjective success that require exploration. However, enhancing workplace spirituality would lead to successful women in the workplace.

## XI. CONCLUSION

Workplace spirituality and glass ceiling beliefs are both emerging topics. However, they have evolved independently of each other. In this paper, the connection between them through the optimism theory (Scheier and Carver, 1992) have been explored. Glass ceiling beliefs demonstrates the positive effect of workplace spirituality. Also, integration of workplace spirituality, glass ceiling beliefs and subjective success would result in a more wholistic approach to studying the three topics.

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# The effect of selected salivary elements and parameters in dental caries experience among a group of preschool children in Al-Najaf Al-Ashraf

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## Abstract:

**Background:** Saliva is composed of anions, cations, nonelectrolytes, amino acids, proteins, carbohydrates, and lipids. Saliva is one of the most important etiological host factors in relation to dental caries. It affects the carious process by its organic and inorganic constituents; in addition to its physiological functions as (flow rate, pH and buffer capacity). The aims of this study were to determine the concentrations of major elements (calcium and phosphorus) and trace elements (ferrous iron, total salivary protein and Copper) in saliva among a group of preschool children, and to explore the relation of these elements, flow rate and pH with dental caries.

**Material and Methods:** The sample consists of 40 children aged 4 and 5 years of age, selected from 4 kindergartens in Al-Najaf AL-Ashraf. Assessment and recording of caries experience was done by the application of decayed, missing, filled index (dmfs for primary teeth) (WHO, 1987). Stimulated saliva was collected from children between 9-11 AM under standardized conditions and chemically analyzed to determine the concentration of calcium, phosphorus, iron, salivary total protein, and Zinc) calorimetrically by using ready-made kits and spectrophotometer machine. Data were analyzed using SPSS version 19.

**Results:** - All elements measured in saliva recorded statistically non-significant correlation with DMFS, except ferrous Fe ions which showed statistically significant correlation ( $r = 0.36$ ,  $P = 0.05$ ). Salivary flow rate and pH correlated weakly and statistically not significant with dmfs. There were weak and statistically not significant correlations between all elements measured in saliva and salivary flow rate and pH.

**Conclusions:** It has been found that Ca and P ion present in high amounts in saliva in comparison to other selected elements. Their presence in saliva may indicate their presence in food, water and air.

**Key words:** salivary pH and flow rate, concentration of Ca, P, Fe, Zn and total protein, caries experience.

## Introduction:

Saliva play a significant role in relation to dental caries through both flow rate and its organic and inorganic constituents, besides the physiological functions. Saliva enhances the clearness of food debris, cariogenic microorganism from the mouth with remineralizing ions (1-3), Therefore saliva plays an important role in the equilibrium between the demineralization and the remineralization of enamel (4). Dental caries remains the most public oral health disease especially among children, it is

also a chronic pathological process (5). Studies showed conflicting results in about the effect of trace elements in correlation to dental caries. There is limitation in the studies concerning these aspects. In order to increase the knowledge about the effect of certain elements in saliva in relation to severity of caries this study was conducted.

## **MATERIALS AND METHODS: -**

### **Subjects**

The subjects selected for this study consisted of 40 children, aged 4 and 5 years of both genders selected from 3 kindergartens in Al-Najaf Al-Ahli AL Ashraf governorate, randomly selected in a systematic random sample, for each volunteer's parents the objectives of the study were explained to, and they approved to participate.

### **Collection of Saliva and Recoding of Caries: -**

For each child sample of Stimulated saliva was collected between 9-11 AM. At least one hour after breakfast. The collection of stimulated salivary samples from children were performed following instructions cited by Tenovou and Langerlof (1996) (6). Each child should sit in relaxed position and was asked to chew a piece of uniform size of Arabic gum (0.35- 0.4 gm.) for one minute then to remove all saliva by expectoration. Chewing was continued for ten minutes, with the same piece of gum and saliva collected in sterile screw capped bottle. Within 15 minutes the Ph of saliva was measured using a digital Ph meter, salivary volume was estimated by measuring cylinder and the rate of secretion was expressed as milliliter per minute (ml/min).

Each salivary sample was centrifuged at 3000 r.p.m. (revolution per minute) for 10 minutes. The supernatant samples were stored and frozen at (-20°C) in polyethylene tubes for subsequent chemical analysis which was carried out in a maximum period of three weeks. Oral examination was carried out by using plan mouth mirror and dental explorer. Assessment and recording of dental caries experience was done by the application of decayed, missing and filled teeth index (dmfs for primary teeth).

Chemical analysis was carried out at Poisoning Consultation Center, Medical city calcium, phosphorus and trace elements (ferrous iron, total salivary protein and zinc) ions were determined using Atomic Absorption Spectrophotometer (AAS). SPSS version 19 (Statistical Package for Social Sciences) was used for statistical analysis. Descriptive measurement (mean and standard deviation) were used to describe variables, statistical tests were applied also for differences between parameters including Person's correlation coefficient. Level of significance was accepted at 0.05, when  $P < 0.01$  was regarded as highly significant. The confidence limit was accepted at 95%.

## **RESULTS: -**

**Table 1- : Caries Experience among Children by Age**

fractions	Mean ± SD (4 years)	Mean ± SD (5 years)	t-test for ages	
			t	Sig
ds	3.89±4.50	6.89±6.05	2.35	Sig
ms	0.00±0.01	0.92±2.03	2.45	Sig
fs	0.44±1.82	0.95±2.25	1.06	Not
dmfs	4.38±6.43	8.83±10.37	3.25	highly

Table (1) show Clinical examinations showed that all children were affected by dental caries. Caries experience (mean value and standard deviation) of dmfs index for all children are presented in Table 1. The decayed surfaces (ds) contributed the major parts of this index followed by filled surfaces (fs) then missed surfaces because of caries (ms). For children involved in this study, statistically significant differences were recorded between children aged 4 years and those aged 5 years for means of ds andms ( $P < 0.05$ ), in addition to that results showed that there were highly significant differences between these ages for means of dmfs ( $P < 0.01$ ).

**Table 2: Concentration of Elements in Saliva (Means ± SD)**

Elements	Mean ± SD (PPM)
P	84.61±01.73
Ca	80.62±22.99
Total protein	0.75±0.17
Fe	0.67±00.25
Zn	0.22±00.12

Table 2, showed the concentration of elements in saliva (mean and standard deviation), Phosphorus ions were found to be the highest in values followed by calcium ions, total protein then ferrous ions and finally zinc

**Table 3: Salivary pH and flow rate (Means ± SD)**

Salivary parameter	Mean ± SD

<b>pH</b>	6.50±0.6
<b>Flow rate</b>	1.07±0.33

Results recorded in table 3, represents (mean and standard deviation) of salivary pH and flow rate of stimulated saliva expressed in ml/min. of all children.

**Table 4: Correlation Coefficient between Elements Measured in Saliva and Salivary (Flow Rate and pH)**

Elements	PH		Flow rate	
	r	P	r	P
<b>P</b>	R	0.06	R	0.25
	P	0.15	P	0.17
<b>Ca</b>	r	0.01	R	0.23
	P	1.01	P	0.27
<b>Fe</b>	r	-0.22	R	-0.33
	P	0.31	P	0.14
<b>Zn</b>	r	0.16	R	-0.09
	P	0.42	P	0.70
<b>Total protein</b>	r	0.07	R	0.14
	P	0.68	P	0.47

Table 4, demonstrates the correlation coefficient between elements in saliva with salivary pH and flow rates. Results showed that all elements measured in saliva correlated weakly with salivary pH and flow rate, where all of these correlations were statistically not significant.

**Table 5: Correlation Coefficients between Salivary (Elements and Parameters) and Caries- Experience**

Elements	Dmfs	
	r	P
<b>P</b>	-0.13	0.47

<b>Ca</b>	-0.05	0.81
<b>Fe</b>	0.36*	0.05
<b>Zn</b>	0.07	0.86
<b>Total protein</b>	0.13	0.57
<b>pH</b>	-0.21	0.28
<b>F.R</b>	-0.25	0.17

Table 5, represent the correlation coefficient between salivary elements and parameters and cariesexperience, only the correlation between ferrous Fe ions and dmfs was recorded as a positive weak and statistically significant correlation while other elements measured in saliva revealed weak and statistically not significant correlations with cariesexperience, the direction of association varied between positive and negative for different elements. Regarding the correlations recorded by salivary parameters with caries-experience results revealed that salivary pH and flow rate recorded a weak negative but statistically not significant correlations with dmfs.

**DISCUSSION**

This study was conducted to explore the possible etiological factors involving some of the salivary elements and parameters and its relation to dental caries. The study group in this research involved 40 children with an age range 4-5 years old. Stimulated saliva is secreted in response to either masticatory or gustatory stimulation, it was collected rather than unstimulated saliva, to allow comparison with other Iraqi studies that were mostly performed on stimulated saliva, in addition to that stimulated saliva is much more easily obtained and more standardized to collect (7,8).

Regarding caries severity among those children, results revealed that the mean values of decayed surfaces represent the present disease, while missing surfaces represent the accumulative effect of dental caries and (dmfs) that represent the caries experience; were significantly higher among children aged 5 years compared to these of 4 years. Which may give an explanation to the increase in severity of dental caries with advancing age reported here in this study. These results could be explained by that, teeth of children aged 5 years old exposed to oral environment and cariogenic factors for longer period of time than teeth of children aged 4 years that no longer had been erupted. It was well established that the increases in severity of dental caries with age due to the fact that dental caries is an accumulative and irreversible disease (9).

In this study a higher calcium and phosphorus concentration were found among children. Results revealed that P ions concentration (84.62ppm) were higher than Ca ions (80.60ppm), this may explain that, in this study by depending on stimulated saliva there will be an increase in the concentration of inorganic phosphorus in comparison to calcium and their level is time- dependent increase as the duration of stimulation increase, while Ca decrease by going from unstimulated to stimulated saliva (2, 3, 10). In addition to that parotid glands contains more inorganic phosphate than does submandibular. Saliva contains less calcium but more phosphate compared to plasma (13,14).(12 ,11)

The variation in the sampling procedure and techniques of analysis in addition to difference in gender and ages among children may explain the variation in these Iraqi studies and others. (7, 15-16).

Salivary ferrous iron, total protein and zinc were recorded in saliva with the concentrations as seen in Table 2. these elements present in our environment as they present in foods, and water that used for drinking or cooking foods so they enter the blood stream via digestive system, lungs or sometimes by coming in contact with skin, their presence in the blood serum, allowed them to be introduced via gingival crevicular fluid into the whole saliva (17, 18), could explain their presence in saliva

dental caries is an accumulative and irreversible disease (9) which give an explanation to the increase in the severity of dental caries with advancing age reported here in this study. The correlation coefficient recorded here between Ca and P ions with dental caries, were found weakly correlated with dmfs and not significant ( $P \geq 0.05$ ), these correlations could indicate the important role of saliva to maintain the integrity of teeth and in the protection of tooth surface against caries development by maintaining supersaturation of Ca and P ions in saliva may enhance remineralization and increase resistance of outer enamel surface to acid dissolution (13). Other elements studied in saliva except Fe were statistically not significant with caries-experience. These findings indicated that iron considered as being caries inert element. Many studies found that salivary iron concentration is inversely related to the dental caries (19,20) while for other elements they have been found that when they increased in saliva caries severity decreased, which may act as cariostatic elements in saliva, these results were conflicting, since saliva is the main source for these elements in the outer enamel surface and these elements were reported by other studies to act as cariogenic elements (21, 22). The concentration of salivary elements changed continuously, since it affected and depends on their presence in systemic environment by type of food, water, presence of disease, air and even drugs as for iron supplements (23). While caries process is a multifactorial and longitudinal process involving interactions of a large number of factors with time (24).

flow rate and pH of saliva considered to be an indicator of caries susceptibility, as the most important caries-preventive functions of saliva are the flushing and neutralizing effects commonly referred to as "salivary clearance" or "oral clearance capacity", so the reduction in salivary flow rate is associated with reduction in buffer capacity and salivary pH, also affects oral sugar clearance negatively may cause the increase in the severity of dental caries (11, 12). There is an inverse association between caries experience and these two variables; such negative correlation was also recorded in the present study.

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# Effect of Topical Application of Sesame Oil on Oral Wound Healing in Rabbits

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## **Abstract**

**Background:** Wound healing is a very complex process, varied and influenced by numerous feature such as the size ,severity nature of the injury and the site of the wound and is consists of four steps: hemostasis, inflammatory reaction, proliferation and remodeling, all of which are regulated by cytokine and growth factors released by cells in the wound area

Medicinal plants have been used for many years for different treatment, sesame oil is one of these medications.The functional activity of lignanspresent in sesame seeds has become of the major interest.

Oil- soluble lignan compound includessesamine free radicals are generated at the site of injury, which are known to impair the healing process by causing damage to cellular membrane ,nucleotides,protein and lipid and sesame oil has a poten antioxidant activity which helps to prevent oxidative damage and promote the healing process.

The aim of this study was to evaluate the effect of local application of sesame oil on acceleration of healing oral mucosa wounds.

**Material and Methods:** Six New Zealand rabbits were used in this study with age between (10-12) months and weight range between(1.5-2) Kg,incisional wounds was done on the internal aspect of check (lining mucosa) for right and left side for each animal,left side was left to heal normally while the right side was treated with seasame oil.

**Result:**Topical application of sesame oil showed marked anti-inflammatory activity on incisional oral wounds and revealed enhancement of wound healing process.

**Conclusion:** Sesame oil has a beneficial role in wound healing, its wound healing properties

**Key words:** Sesame oil, wound healing.

## **Introduction:**

The oral mucosa is the mucous membrane that lines the inside of the mouth,itcomprises of stratified squamous epithelium termed oral epithelium and an underlying connective tissue termed lamina propria, at the lip the oral mucosa is continuous with

the skin ,thus the oral mucous membrane is located anatomically between the skin and the gastrointestinal mucosa and show some properties of each(1).

There are three types of oral mucosa can be recognized according to their primary function and histology:1- the lining mucosa ,non-keratinized stratified squamous epithelium which represent the largest part of the oral mucosa,it form about 60% of the oral mucosa and cover the floor of mouth, lines the checks, lips and soft palate and its loosely attached to underlying tissue.2-the masticatory mucosa,keratinized stratified squamous epithelium found on the dorsum of the tongue, hard palate and attached gingiva,it form only 25% of oral mucous membrane and its firmly attached to the underlying tissue.3-the specialized mucosa which occupying smaller area about 15% of oral mucous membrane which cover the dorsum of the tongue and it contain taste buds(2).

Non keratinized mucosa is significantly thicker than keratinized mucosa and successfully withstands the hearty shearing forces of a prosthesis following oral mucosa transplantaion in the oral cavity, furthermore non-keratinized mucosa contain more elastic fibers than keratinized mucosa(3)

The wound is generally damage to tissue resulting in the interruption of the original tissue architecture ,culture and homeostasis,wound can be caused by almost any injurious agent and can include almost any tissue or structure(4)

Wound healing is a complex process, which is generally divided into three phases including the invasion of inflammatory cells, proliferation of tissue-repairing cells, and remodeling of the tissue. The level of wound healing depends upon many factors including wound size, blood supply to the area, foreign bodies presence, microorganisms, age, the health of the patient, nutritional status of the patient, drug usage, and a variation of systemic diseases (5).

Wound healing has a complex event formed by cells migration and proliferation such as fibroblasts, endothelium and epithelium cells as well as migration of cells originating from blood such as thrombocytes, macrophages and neutrophils, successful wound healing involves fibroplasia, angiogenesis and re-epithelisation(6), Fibroplasia is the stage at which proliferation of fibroblast required for contraction of wound occurs as well as synthesis and storing of the matrix necessary for the formation of new vein and epithelium. Wound contraction, carried out by myofibroblasts, which are specific fibroblasts, is an essential stage of healing ,delay in this process results in wound healing failure or prolongation(7).

Local and systemic factors affecting on the process of wound healing ,local factors including : oxygen and infection ,while systemic factors including :age, sex hormone,stress,drugs,smoking and carbohydrate,protein and amino acid .(8)

There is a relationship between wound healing in human and certain animal species therefore, the present study employed a model of rabbit wound healing for the assessment of the influence of sesame oil in wound healing.(9)

## Materials and Methods:

Six New Zealand white rabbits were used in this study, age (10-12) months and their weight range between (1.5-12) kg.

Animals were divided into three groups according to healing interval period (3,5,7) days, two animals for each period and were housed in individual cages with freely have access to water and food .

Animals were subjected to anesthesia by intramuscular injection of ketamine 10% (1 mg/kg) of body weight and Xylazine 2% (0.2 ml /kg) of body weight, incisional wound was induced on lining mucosa for right and left side of cheek that include all layers of mucosa (Epithelium, lamina propria and connective tissue) and right side left to heal normally while left side was treated with sesame oil ,the treatment were applied topically at once time and at the same day of doing wound, the wound left undressed and evaluated daily.

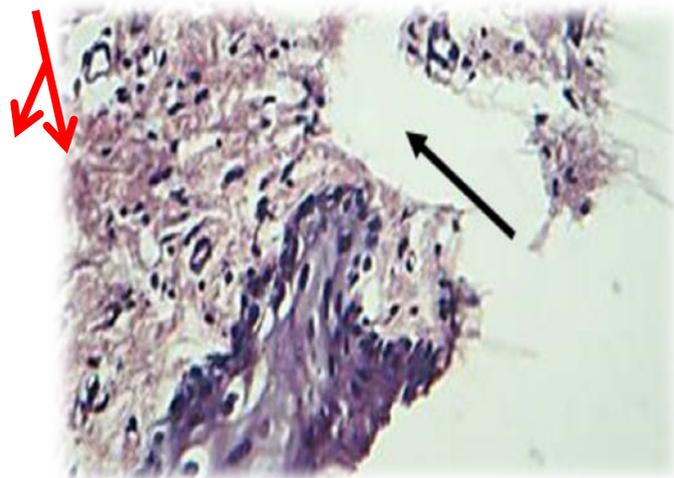
## Result:

### Histological finding:

Three days duration:

A-Control group

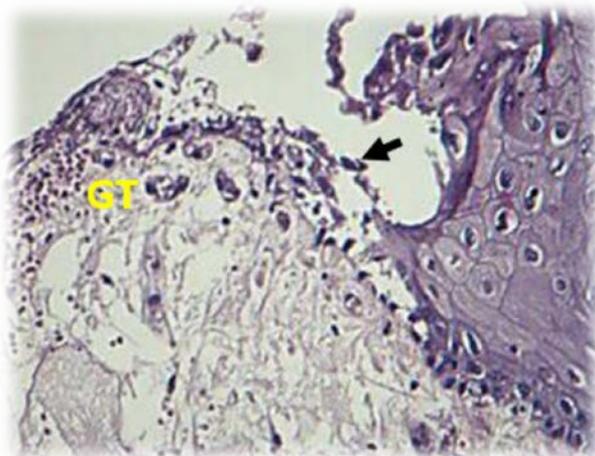
Histological view at wound site of three days healing period of lining mucosa ,shows the defect area, no epithelium is formed and necrotic tissue is seen with numbers of inflammatory cells



**Figure1: View of 3days duration in control group shows cut edge of wound (arrow),inflammatory cells (IC).H&Ex20**

**B-Experimental group:**

Microphotograph view at wound site of three days duration shows granulation tissue with congested blood capillaries and large numbers of inflammatory cells and fibroblast.

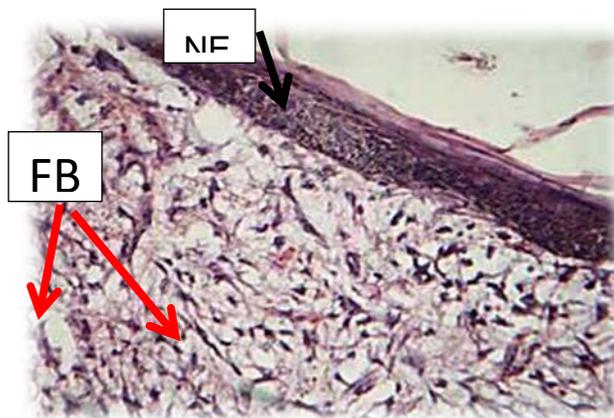


**Figure 3: Microphotograph of wound site shows granulation tissue at cut edge of wound, migrating epithelial cells (arrow) .H&EX10.**

**Five days duration:**

**A-Control group:**

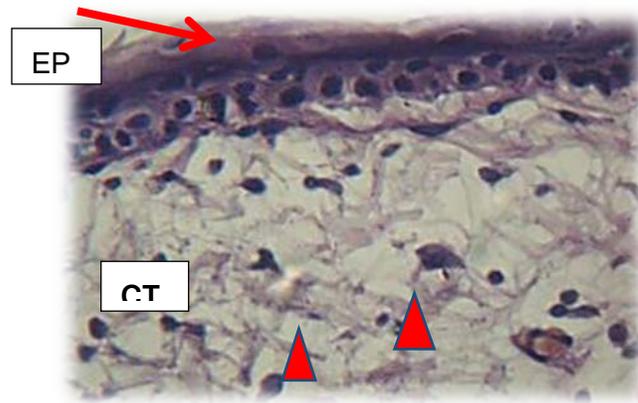
Microphotograph view at wound site of five days duration shows new epithelium is formed and fibroblast



**Figure (3):View of of control group after5 days show new epithelium(NE) and fibroblasts(FB) ).H&Ex20**

**B-Experimental group:**

Histological finding of five days' duration shows reduction in number of inflammatory cells and replacement of granulation tissue by fibrous connective tissue with scattered fibroblast and complete epithelization is seen too

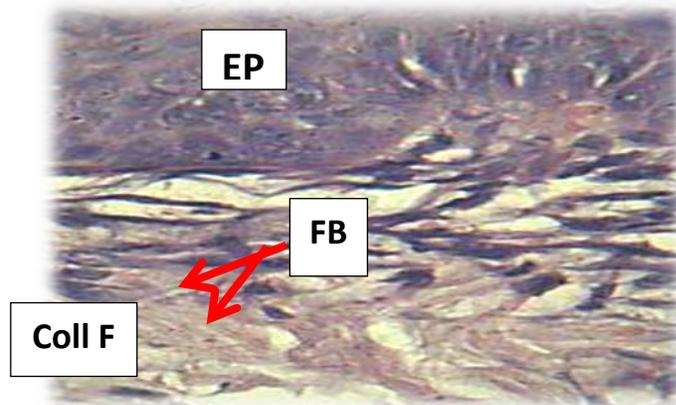


**Figure4: View of wound site of experimental group after 5days, shows fibrous connective tissue (CT) ,scarce number of inflammatory cells (IC) ( head arrow )and epithelium(EP).H&Ex20**

**Seven days duration:**

**Control group:**

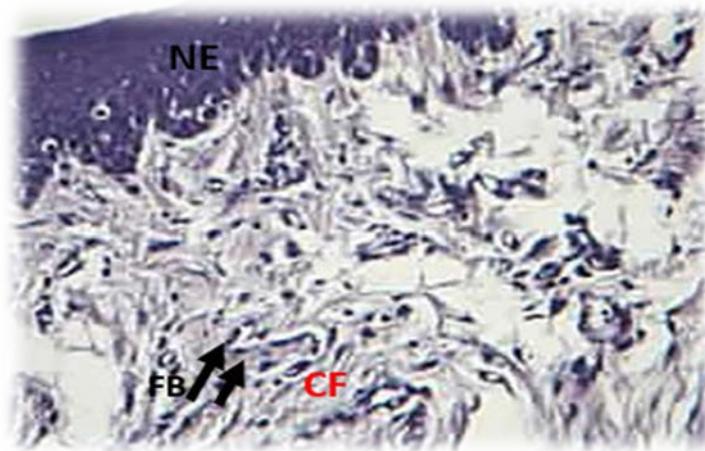
Histological section at control wound site of 7 days shows epithelium, collagen fibers and fibroblast.



**Figure5:view of 7days duration of control group, shows epithelium (EP),collagen fibers(Coll F) and fibroblasts(FB) ).H&Ex20**

**Experimental group:**

Histological finding of 7 days post operatively revealed complete healing of wound area and shows cell layers of new epithelium , , fibroblast and collagen fibers.



**Figure6: Microphotograph of 7daysduration of control group shows new epithelium, organizing collagen fibers(CF) and fibroblasts (FB). H&EX20.**

#### **Discussion:**

Wounds are denoted to as an interruption of normal anatomic structure and function.

Wound healing is a very complex, multifactor sequence of events comprising several cellular and biochemical processes which include a natural body reaction to injury, initiated nearly after wounding and occurs in four stages, the first phase is coagulation which controls excessive blood loss from the damaged vessels, the next stage of the healing process is inflammation and debridement of wound followed by re-epithelization which includes proliferation, migration and differentiation of the epithelial cells, in the final stage of the healing process collagen deposition and remodeling will occur.

In the present study, we have examined the characteristics of sesame oil in oral wound healing.

The result of the present study showed that the defect area. No epithelium is formed at 3 days of incision in the control group and this histological observation is in agreement with (Niksaei et al, 2010) who carried the study on rabbit skin and found the wound in the control group at 2 days is still open and consists of a large defect area, while in the experimental group at 3 days duration shows granulation tissue is formed and there is a number of inflammatory cells at the wound site and this is in agreement with (Abdalbari, 2009) whose histopathological finding at 3 days period showed granulation tissue with inflammatory cell infiltration.

The result of the present study showed that new epithelium is formed and there is a high number of inflammatory cells and fibroblasts at 5 days of the control group and this result is in agreement with (Zainab Abdul Kareem, 2009) who improved that there was highly evidence of inflammatory cells in the first week on wound done in rabbit skin.

At 5 days histological finding showed reduction in number of inflammatory cells with fibrous connective tissue formation and this is in agreement with (Abdalbari, 2009).

In the control group at 7 days of incisional wound histological evaluation revealed complete epithelization and this result agrees with (Warqaa Mahmood, 2010) who improved that new epithelium formation was complete at 7 days of incisional wound in the control group at skin of mice, while in the experimental group at 7 days, the histological results showed complete healing area and fibrous connective tissue and this agrees with (Warqaa Mahmood, 2010).

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# Ambient Air Heavy Metals Monitoring In NCR Region

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**Abstract-** The present study deals with the ambient air quality monitoring with respect to heavy metals (Pb, Ni and As) concentrations in PM<sub>10</sub> at seven locations of NCR region, a National Capital Region of India. The 24 hr mean concentrations of PM<sub>10</sub> ranged between 126 to 237.67 µg m<sup>-3</sup>, which is beyond the permissible limit (100 µg m<sup>-3</sup>) of National Ambient Air Quality Standards (NAAQS) also found higher than the prescribed annual daily limit of US EPA (50 µg m<sup>-3</sup>). The ambient air was mostly dominated by the Ni and least by the As among the metal analysed. Ghazipur, a dumping site and also influenced by heavy vehicular transportation due to near highway, is found to be the most polluted area of NCR region and Mayur Vihar phase-I, Delhi the least. The ambient air of Ghazipur is rich in Ni, indicating contribution of dumping and also mobile sources. The Indrapuram, Ghaziabad a residential place near the industry, is rich in Pb but within the permissible limit, suggesting contribution of point sources. The Ni concentration is found to be alarmingly high in the air at three locations i.e. Ghazipur, Vasundhara (Ghaziabad) and Noida Sec-26, when compared with the WHO limits (10 ng m<sup>-3</sup>). The As concentration is found to be below the detection limit at all locations. The present study has focused on to understand the concentrations of heavy metals in ambient air and also to analyse the quality of air in NCR region due to presence of huge vehicular transportation and industrialisation, which is extremely harmful due to their toxic and carcinogenic nature.

**Index Terms-** Ambient air monitoring, Heavy metals, air pollutants, PM<sub>10</sub>.

## I. INTRODUCTION

Heavy metals are released into the atmosphere from a wide range of anthropogenic and natural sources. Trace quantities of heavy metals are found in fossil fuels and they are released into the atmosphere following combustion processes, including power generation and emissions from vehicles. Industrial processes, including the manufacture of steel and iron, and other metallurgical and chloro-alkali industries are also significant sources of heavy metals. Different industries release different metals, for example, lead emissions, which were previously almost completely from road transport, are now dominated by processes in the iron and steel sector. The largest source of arsenic is the burning of wood which has been treated with copper-chrome arsenate. Non-combustion sources of heavy metals include Demolition of buildings, corrosion and abrasion of sources such as road surfaces, tyre and brake wear.

It is important to note that in addition to these anthropogenic sources, heavy metals are also released into the atmosphere from natural sources including volcanoes, forest fires, sea-spray and wind-blown soil particles. As they are chemical elements, heavy metals do not degrade. This means that any metals which are released to the environment have the potential to become re-suspended in the atmosphere, for example, windblown particles of soil and road dust. The paper presents the data collected on the presence of selected heavy/trace metals in the ambient air of NCR region during the air sampling studies at seven different locations. The three heavy metals which are monitored and analyzed are Arsenic (As), Lead (Pb), Nickel (Ni).

The objective of the study is to analyse quality of air in Delhi-NCR area and measurements of the concentration of Heavy Metals in Ambient Air and their health effects. For each heavy metal to identify sources, including point, area and mobile sources, and their comparative importance in terms of emissions and contribution to ambient air levels and also for each heavy metal, to identify and discuss any long-term trends in ambient air levels found in the data.

## II. MATERIALS AND METHODS

Ghazipur, Delhi is an industrial area with a residential population. Overall this area is surrounded by different types of industries like aluminum product manufacturer, lead manufacturing producing lead, lead alloy manufacturers, ferrous metal unit, carbon product manufacturer. We considered the ghazipur dumping site as the central location for our study area. Seven monitoring sites were selected. All the seven locations are as: (i) Ghazipur- near to dumping site, (ii) Vasundhara sec-16, Ghaziabad-residential place, (iii) Vasundhara enclave, Delhi – institutional area, (iv) Mayur vihar- latitude 28.6077°N and longitude 77.2992°E.(v) Noida sec-1- latitude 28.57°N and longitude 77.32°E elevation is 200m (vi) Noida sec-26, 20 Km southeast and 20 Km northwest (vii) Nitikhand-II, Ghaziabad- residential area. Out of 7 locations, 5 locations (Ghazipur, Vasundhara sec-16, Noida sec-1, Noida sec-26, Indrapuram Nitikhand-II) are comes under residential area. At Mayur vihar phase-1, Delhi monitoring carried out in the School (ASN Sr.Sec.school) and Vasundhara Enclave, Delhi monitoring carried out in the College (M. Agrasen college). Therefore, these locations may be considered as residential cum Institutional area. All the two locations were also influenced by the vehicular pollution.

The study was carried out in the month of June 2012. The temperature and relative humidity was recorded hourly by auto

weather station (model WM 200, Envirotech, New Delhi). During this period, the daily mean of average temperature and relative humidity ranged between 28.6 to 34.81o and 57.8 to 91.7% respectively. Respirable dust samplers (RDS) were used for the monitoring of particulate matter at all the locations at an approximate height of 1.5 m from ground level. Monitoring was carried out for one week, and the collection was done continuously for 24 hr with RDS for RSPM and for Heavy metals detection. The PM samples were collected at flow rate of 1.1-1.2 m<sup>3</sup> min<sup>-1</sup> on Whatman EPM 2000 borosilicate glass micro fibre filters. The mass of collected particles was

determined gravimetrically after drying. The total volume of air was calculated by multiplying average flow rate by total sampling time in minutes. After sampling extraction of sample is done by using hot plate procedure in which filter paper is digested with 3% HNO<sub>3</sub> and 8% Hcl. Final extracted sample is ready for the analysis which is done with ICP-OES (Inductive coupled plasma- optical emission spectroscopy). For Lead (Pb) and Nickel (Ni), the wavelength required for analysis is 217nm and 232nm respectively. Where as in case of Arsenic (As), the wavelength required for analysis is 193.7nm.

### III. RESULTS AND DISCUSSION

**Table 1: Avg. Conc. of Heavy Metals in NCR in the month of June**

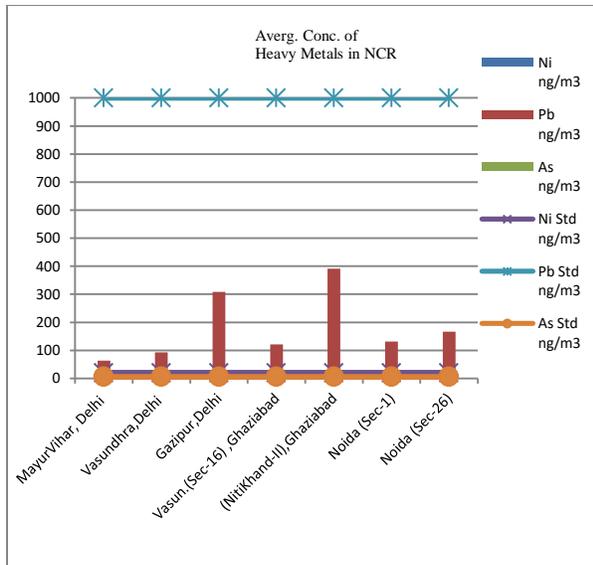
Locations	Ni ng/m <sup>3</sup>	Pb ng/m <sup>3</sup>	As ng/m <sup>3</sup>
Mayur Vihar Phase-I (ASN School), Delhi	BDL	63	BDL
Vasundhra Enclave (Maharaja Agrasen college), Delhi	BDL	93	BDL
Ghazipur (New Police station), Delhi	26	308	BDL
Vasundhra(Sec-16) , Ghaziabad	20.5	121	BDL
Indirapuram (NitiKhand-II), Ghaziabad	BDL	391	BDL
Noida (Sec-1), U.P.P.C.B	BDL	132	BDL
Noida (Sec-26), Apollo Hospital	20	167	BDL

**Table 2: Ratio of Pb to PM<sub>10</sub>**

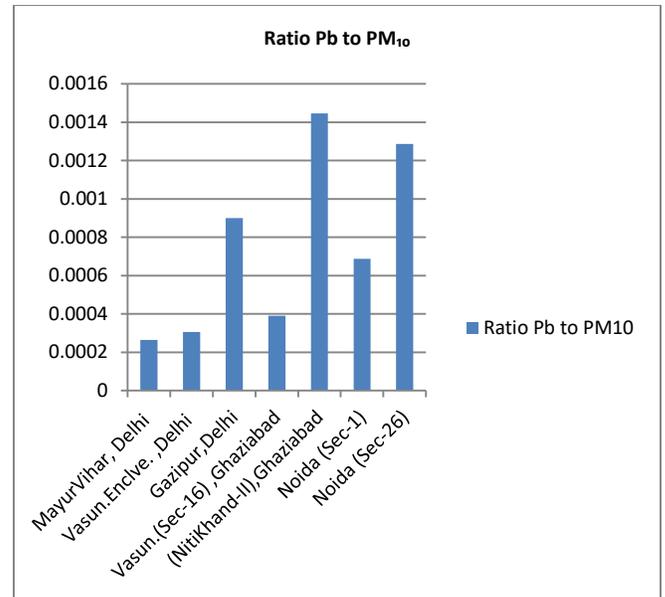
Locations	Pb ug/m <sup>3</sup>	PM <sub>10</sub>	ratio of Pb to PM <sub>10</sub>
MayurVihar Phase-I(ASN School),Delhi	0.063	237.67	0.000265
Vasundhra Enclave (Maharaja Agrasen college),Delhi	0.093	304.67	0.000305
Ghazipur (New Police station),Delhi	0.308	342.33	0.0009
Vasundhra(Sec-16) ,Ghaziabad	0.121	309.67	0.000391
Indirapuram(NitiKhand-II),Ghaziabad	0.391	270.33	0.001446
Noida (Sec-1), U.P.P.C.B	0.132	192	0.000688
Noida (Sec-26), Apollo Hospital	0.167	126	0.001286

**Table 3: percentage of Pb in PM<sub>10</sub>**

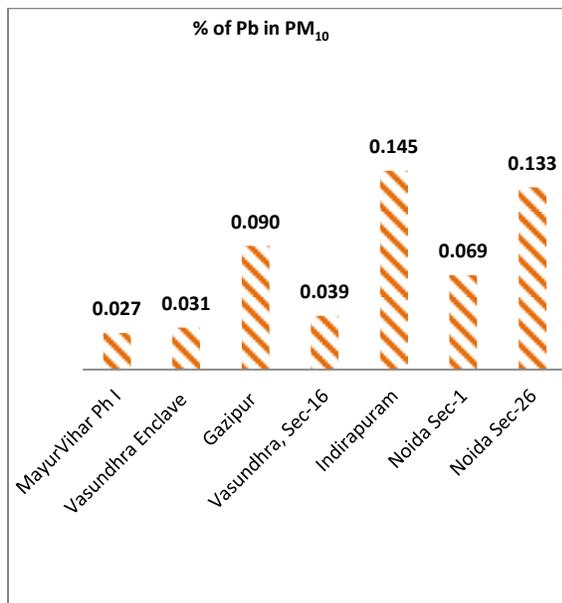
Locations	Pb ug/m <sup>3</sup>	PM <sub>10</sub>	% of Pb in PM <sub>10</sub>
MayurVihar Phase-I(ASN School),Delhi	0.063	237.67	0.026507
Vasundhra Enclave (Maharaja Agrasen college),Delhi	0.093	304.67	0.030525
Ghazipur (New Police station),Delhi	0.308	342.33	0.089972
Vasundhra, Sec-16,Ghaziabad	0.121	309.67	0.039074
Indirapuram (NitiKhand-II),Ghaziabad	0.391	270.33	0.144638
Noida (Sec-1), U.P.P.C.B	0.132	192	0.06875
Noida (Sec-26), Apollo Hospital	0.167	126	0.13254



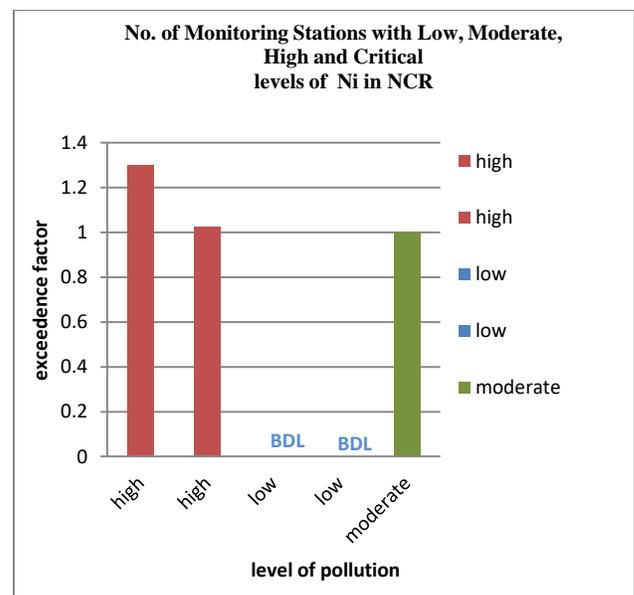
**Fig 1: Average conc. of Heavy metals in NCR region**



**Fig 2: Ratio Pb to PM<sub>10</sub>**



**Fig 3 % of Pb to PM<sub>10</sub>**



**Fig 4: number of monitoring stations with Low, Moderate, High and Critical level of Nickel in Delhi- NCR region.**

The study provides valuable preliminary data on regional ambient concentrations of heavy metals in Metropolitan Delhi and NCR area.

The range of Lead (Pb) is 63 ng/m<sup>3</sup>-391 ng/m<sup>3</sup> in the seven locations. The minimum

Value found at Mayur vihar phase-I, Delhi The maximum value found at value at Nitikhanda-II Indrapuram, Ghaziabad. This is mainly due to the heavy vehicular transportation. The second highest value is found at Ghazipur, Delhi 308 ng/m<sup>3</sup> which is mainly due to the burning of waste in the landfill site. These values are slightly higher but under the Pb ug/m<sup>3</sup> National Ambient Air Quality Standard (NAAQS) (1.0 µg/ m<sup>3</sup>) prescribed by the Central Pollution Control Board (CPCB) of India (MoEF, 2009) and around times the annual Pb ug/m<sup>3</sup> air quality guideline (AQG) (20 µg m<sup>-3</sup>) set by the World Health Organization (WHO, 2006).

Nickel(Ni) during monitoring found at only 3 locations i.e.Ghazipur-26ng/m<sup>3</sup>, Vasundhara sec-16, Ghaziabad.- 20.5 ng/m<sup>3</sup>,and Noida sec-26- 20ng/m<sup>3</sup> and at other locations Nickel is found below the detection limit. The higher concentration at Noida sec-26 is due to civil construction work impact in this area. These values are above the Ni ng/m<sup>3</sup> National Ambient Air Quality Standard (NAAQS) (20 ng/ m<sup>3</sup>) prescribed by the Central Pollution Control Board (CPCB) of India (MoEF, 2009).

Arsenic was found below its detection limit at all the seven locations. There is no relevant concern for Arsenic in ambient air, the measured concentrations of this relatively low toxicity metal because it is below the detection limit.

Nickel concentration is high as compare to the lead and arsenic. The level of Ni at seven locations of NCR region with low, moderate, high and critical level is found. At 2 locations Mayur Vihar Phase-I, Delhi and Ghazipur, Delhi the Nickel concentration is found to be high due heavy transportation and nearer site of metro station. At Noida sec-26 the concentration was found to be moderate due to high transport activity and also due to industrialization of that area. By Air Quality assessment we have found that the area with Critical pollution (C): when EF is > 1.5 High pollution (H): when the EF is between 1.0 - <1.5; Moderate pollution (M): when the EF between 0.5 - <1.0; and Low pollution (L): when the EF is < 0.5.

Lead is very toxic to the human health as well as for the environment. Their relatively high toxicity should represent a concern at a regional level. The lower concentration of lead was found presumably due to the official ban of leaded gasoline in all over India.

Lead to PM<sub>10</sub> ratio was found to be higher at Nitikhanda-II, Ghaziabad and presents in higher amount in Pb to PM 10 ratio which is not good for health. Nitikhanda-II is an industrial area many small working industries are there which is causing the release of heavy metals in ambient air.

The Lead concentration at Ghazipur, Delhi was elevated with respect to other regions. It is likely that these concentrations may be associated with dust containing lead and also due to the burning of waste at dumping site which backside to the monitoring site.

Average concentration of Nickel and Lead found higher representing impacts of industrial sources present in the upwind direction (possibly in the form of metal smelting, metal product manufacture and industrial oil combustion) suggesting crustal origin.

#### IV. CONCLUSIONS

The three metals Pb, Ni, As associated with PM<sub>10</sub> were characterized at Delhi- NCR region, we need to identify and quantify their major sources. Crustal source (49–65%) having significantly higher contributions in summer. The loading factor was probably due to resuspension of road dust by vehicular turbulence. So, this factor represents vehicular sources. According to the Noida office of the Uttar Pradesh Pollution Control Department, the residential colonies have a higher level of air pollution because of the growing number of automobiles. A rise in the number of restaurants, roadside eateries and power generators has also been a contributing factor. Pb and Ni concentration at Noida is high."In spite of the presence of a decent public transport system, which includes the Delhi Metro, the number of registered and unregistered vehicles has increased dramatically in Noida. The smoke released by individual households has led to the shooting up of the pollution levels in residential areas .As per the report, 70% of the total air pollution in Noida is caused by automobiles, 20% by industries and 10% by households. Ghaziabad is an industrial area and total of 67 industries categorized as Large & Medium units & 313 units under SSI category have been identified under Red Category Polluting Industries in the area. Major industrial sector of concern from Air Pollution point of view. Induction Furnace - Such industries are marked with generation of substantial amount of process of Air Emission. Provision of secondary hoods & additional ID Fan etc. for collection of entrapped Air Emission in all the Induction Furnaces. Crustal sources dominated with 49–65% contribution to ambient metals on a mass basis. Delhi Government took up 59 projects/schemes (mostly construction-related) all over the city. These might have served as local sources of crustal matter at the sites. On the other hand, its seasonal variation was highly significant with distinctly higher contributions in summer. Summer- time migration of trans-boundary dust carried by strong westerly and northwesterly winds might be an important factor contributing to this source. Vehicular sources contributed 27–31% at the sites with insignificant spatial and seasonal variations. This shows that traffic was nearly ubiquitous at all the sites and the nearness of these sites to traffic precluded the importance of atmospheric conditions on the transport of traffic-generated metals to the sites. Most of the small-scale industries located in Delhi cannot afford pollution abatement technologies and pose severe problems for effective monitoring and enforcement.

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# EFFECT OF TRAINING FEEDBACK ON THE PERFORMANCE OF NON-TEACHING MANAGEMENT EMPLOYEES AT SELECTED PUBLIC UNIVERSITIES IN KENYA

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**Abstract-** The aim of this study was to establish the effect of training Feedback on the performance of non-teaching employees in selected public universities in Kenya. The study was conducted in eight of the twenty-two public universities in Kenya with a sample size of 176 non-teaching employees. The study was both qualitative and quantitative. Qualitative due to descriptive statistics which were used in interpreting data and, quantitative due to data obtained from questionnaires that was interpreted using statistical packages like SPSS V 20, and Stata V 12, and analysis was done by regression and correlation. The study used open and closed ended questionnaires and a Likert measurement scale of 1 to 5. The study results revealed that training feedback ( $p$  value = 0.001) was statistically significant and therefore had influence on the performance of non-teaching employees at the selected public universities in Kenya.

**Key Words-** training, performance, non-academic, training feedback

## 1. INTRODUCTION

Higher education in Kenya can be traced back to 1922 when the then Makerere College in Uganda was established as a small technical college which was then expanded to meet the needs of the three East African countries i.e. Kenya, Uganda and Tanganyika and Zanzibar, as well as Zambia and Malawi. In the 1940s and early 50s it is only this college that was providing university education in East Africa. This lasted until 1956 when the Royal Technical College was established in Nairobi. In 1963, the Royal Technical College became the University College in Nairobi following the establishment of East Africa University with three constituent colleges in Nairobi, Dar es Salaam and Kampala (Makerere). The East Africa University offered University of London's programmes and degrees till 1966. In 1970, the East Africa University was dissolved to create three autonomous universities in Nairobi, Dar es Salaam and Makerere (Chacha, 2004). The University of Nairobi was thus established as the first university in Kenya offering degrees in Bachelor of Arts, and Bachelor of Science in Engineering under the University of London (Kipkebut, 2010).

Kenyatta College that offered Diploma education became a constituent college of UoN. Since 1980, a great expansion of public universities was experienced and, with high demand for university education, six more universities were established for instance Moi University was established in 1984, following recommendation of a working presidential party chaired by Professor MacKay. Kenyatta University was elevated to university status in 1985, and is well known for offering degrees in education.

Following the same demand for university expansion and for reasons of political expediency, two more universities were set up within two years: Egerton University and Jomo Kenyatta University of Agriculture and Technology. Between that time and now, two other universities have been established: Maseno University and Masinde Muliro University (Odhiambo, 2011). About twenty three private universities were also established to help to alleviate the pressure of demand for university education in Kenya and operated under Commission for Higher Education (Mwiria et al., 2007)

Universities are expected to make contributions to national development through training and development of human resources in various professions for the labor market (Mwiria et al., 2007). According to UNESCO World Conference on Higher Education (1998), low funding from the exchequer, increased enrolment, limited access compared to the population level, increased enrolment

without commensurate improvement in available facilities, gender inequality, and a low research capacity, are some of the problems facing universities in the region.

These problems have led to extreme pressure on the human and physical resources making it difficult for universities to maintain reputable levels of performance in relation to their core mandate of teaching and research. Employees' dissatisfaction because of various monetary and non-monetary factors is another major area of concern for public universities because it is resulting in high turnover rates among academics while those who have remained are actively involved in moonlighting activities to supplement their income (Kipkebut, 2007).

Abagi et al. (2007) also posits that Kenyan Universities have destroyed middle level colleges in a bid to extend university education to the public especially in remote regions. Universities should involve other stakeholders if they have to survive for instance government, private sector and international community. They should also observe quality, excellence, equity, responsiveness, governance and management (Kipkebut, 2007).

Kipkebut (2007) found that academic staff lacked respect for non-teaching employees. Administrators were most appreciated or acknowledged for skill or knowledge in their everyday work (a case of Australia). In the case of USA, UK, Finland and Netherlands, Dobson et al. (2000) cited lack of appreciation of differences in nature of work between administrators and faculty caused tension.

## 2. LITERATURE REVIEW

The Adult learning training was developed by Knowles (2013), out of a specific theory of how adults learn. The most popular mode of learning has been for youth and children (Pedagogy). Pedagogy gives the instructor major responsibility for making decisions about learning content, method and evaluation. Students are seen as generally being passive recipients of directions and content, bringing few experiences that may serve as resources to the learning environment. Educational psychologists recognized limiting factors in formal education theories and hence developed andragogy (Noe, 2010).

Andragogy the theory of adult learning (Knowles, 2013), is highly associated with adult learning theory. Knowles theory is based on the assumptions that adults have the need to know why they are learning something, have a need to be self-directed, bring more work related experiences into the learning situations, enter into a learning experience with a problem centered approach to learning, and, are motivated to learn both by extrinsic and intrinsic motivation. The learner and trainer are both involved in creating the learning experience and ensuring that learning occurs.

At the completion of any training, the trainer conducts an assessment by interviewing and administering questionnaires to the learner so examine whether the training matched the expectations of the learner since in andragogy the trainee is involved in creating the learning experience as well; and this is part of feedback. Upon successful completion of the training, the employee can be promoted, appraised and recommended for better placement or remuneration. The environment of Andragogy must be safe and there should be a sound relationship between trainer and learner for effective learning and development (Jones, 2016).

The study revealed that Reinforcement theory was dominant as it emphasized the power and control of simple learning principles. First, the **Stimulus** must be identified and **Response** follows after which **Output**/reward is administered as indicated (S  $\longrightarrow$  R  $\longrightarrow$  O). The reward may be reinforced in case of positive stimuli or withheld in case of negative stimuli but punishment may be administered instead. In the case of negative stimuli, the reinforcement inform of punishment fails to motivate the learner to perform. Such a learner may never appreciate the effect of either the positive or negative reinforcement and therefore the learner continues to perform poorly.

In the course of training session, the learner must follow instructions step by step until the process is complete. Sometimes assessment is carried out to establish whether learning took place. The trainees who pass assessment are rewarded by some incentives such as compliments, acknowledgement certificates, promised promotion, secondment or salary increase. Coupled with knowledge and skills attained during training, the trainees are motivated to perform better in their areas of operation (Noe, 2010).

According to Opu (2008), feedback is the last step in the training process whereby trainees are asked to fill a form expressing their experiences during the training. The questions seek to establish aspects of the training communication effectiveness on the part of the trainer, relevance of topics, and whether training objectives were achieved.

Akala (2010) observed that during performance appraisal and performance contract exercises, non-teaching employees are evaluated against agreed organizational goals and objectives. The strengths, weaknesses, opportunities and threats of the employees' performance evaluation outcome are determined and appropriate action taken. The action may be promotion, transfer, granting of awards, and recognition, further training, as incentives to make the employee perform better. Sometimes employees may suffer due to the biased nature of appraisal systems. Noe (2010) contends that advanced technology, coupled with affordable costs for accessing technology has influenced delivery of training, making it real and has enabled employees to choose convenient places of work.

### 3. METHODOLOGY

The study adopted the Survey design and Correlation research designs. Survey strategy allows collection of quantitative data which can be analyzed quantitatively by use of descriptive and inferential statistics.

Mugenda and Mugenda (2003) also indicate that Correlation research design is basically concerned with assessing relationships among variables. It is thus based on the premise that if a statistically significant relationship exist between two variables, then it is possible to predict one variable using the information available on another variable.

The sampling method was chosen according to Kothari (2008) who maintain that stratified random sampling helps to achieve intended representation from various sub-groups in any given population, and guarantees minimal bias. In the study, the population was divided into meaningful, subsets that do not overlap and, the subjects were chosen from each subset. The study used stratified random sampling because the population is heterogeneous. The total population of non-teaching employees in the target population was 450.

The Sample given was statistically determined using the indicated formula, since the total population was less than 10,000 (Mugenda & Mugenda, 2003).

$$n = \frac{z^2 p q}{d^2}$$

Where:

n= the desired sample (if the population is greater than 10,000).

z= the standard normal deviate at the required confidence level

p=the proportion in the target population estimated to have characteristics being measured.

q=1-p

d= the level of estimated significance set.

For instance, a target population with a characteristic .50, the z - statistic is 1.96, and desired accuracy at 0.05 level, the sample size will be:

$$n = \frac{(1.96)^2 (.50) (.50)}{(0.05)^2} \\ = 384$$

In this case, the target population was less than 10, 000, and the required sample size was smaller. To get the sample size therefore, the formula given by Mugenda and Mugenda (2003) has been adapted in this study.

$$nf = n / (1+ n)/N$$

Where:

nf= desired sample size when the population is less than 10,000

n = desired sample size when population is more than 10,000

N= the estimate of population size

For instance:

$$= 384 / (1+450) / 384$$

$$= 384 / 1+ 1.17$$

$$nf = 176$$

$$\text{Percentage} = 176 / 450 * 100 = 39\%$$

The study worked with 39%. Mugenda and Mugenda (2003), recommend that 10% of the accessible population is adequate, and at least 30 cases are required per group, for statistical data analysis.

The accessible population or the respondents were drawn from the 8 out of the 22 public universities in Kenya. A sample of (36%) 8 public universities out of the total 22 public universities were selected for the purpose of this study. The study used Non-probability sampling specifically purposive sampling technique to select the 176 non-teaching staff in management level at public universities. Table 3.1 below illustrates the sampling frame developed by the researcher of the 8 selected public universities operating in Kenya.

**Table 3.1 Sample Frame**

Name of selected public university	No of Non-Teaching Employees at management level	Grades of the Non-Teaching Employees at management level			Sample Size
		13	14	15	
JKUAT	67	11	11	5	27
KU	65	12	11	4	27
MOI	63	11	10	3	24
Eldoret	50	9	8	3	20
UoN	66	11	11	3	25
Egerton	54	9	9	2	20
Maseno	35	5	5	3	13
MMUST	50	9	8	3	20
<b>TOTAL</b>	<b>450</b>	<b>77</b>	<b>73</b>	<b>26</b>	<b>176</b>

A structured questionnaire was used to obtain the data. A Pilot study of 10% (17 respondents) of the desired sample size of 176 respondents will be carried out at Kenyatta University, Nairobi University and Jomo Kenyatta University. According to Mugenda and Mugenda (2003) the purpose of the pilot study is mainly to pretests the instrument to ensure that the items in the instrument are stated clearly and have the same meaning to all the respondents. The pretest enabled the study asses the clarity of the instrument and asses the time taken to administer the instrument. The reason for choice of 3 universities: Kenyatta, Nairobi and Jomo Kenyatta University of Agriculture and Technology is because they have similar characteristics and features as the other universities in Kenya. The pretest was subjected to the internal consistency technique using the Kuder-Richardson (K-R) 20 Formula which is as follows:

$$KR20 = \frac{K(S^2 - \sum s^2)}{S^2(K-1)}$$

Where:

- KR20= Reliability coefficient of internal consistency
- K = Number of items used to measure the concept
- S<sup>2</sup> = Variance of all scores
- s<sup>2</sup> = Variance of individual items

A high coefficient will imply that items correlate highly among themselves indicating that there exists consistency among the items in measuring the concept of interest (Mugenda & Mugenda, 2003).

Data was analyzed using quantitative analysis. The first step described and summarized the data by use of descriptive statistics. This enabled the researcher to meaningfully describe the distribution of results depending on the variables in the study and the scale of measurements used. Descriptive statistics such as Measures of central tendency (Mean, Mode and Median) and Measures of variability (range, standard deviation, frequency distribution, histograms, frequency polygons, bar charts, percentages and relationships) was used in analyzing the data. Inferential statistics on the other hand was used to make inferences about the population based on results obtained from samples. In this study, the researcher used regression and correlation tests which attempted to establish the relationship between independent variables and the dependent variable. The questionnaires were coded and the data was keyed into the computer using Statistical Package for Social Science (SPSS V-17) as well as STATA (10/12) Statistical Software. The statistical software's were used to analyze both descriptive. The results were presented using charts, graphs and tables.

#### **4. RESEARCH FINDINGS, CONCLUSION AND RECOMMENDATION**

##### **4.1 Respondents view on Training Feedback from Likert Scale**

The study sought to establish the extent to which observations made by trainer and shared with the employees' improved performance. 1.8% of the respondents strongly disagreed, 2.3% disagreed, 2.3% were not sure, 35.0% agreed and 58.6% strongly agreed that observations made by trainer and shared with the employees' improved performance. Generally, 4.1% disagreed, 2.3% were not sure, and 93.6% agreed that observations made by trainer and shared with the employees'. The study agreed with Irawanto (2015) who argued that employee involvement in decision making is a strategy that enhances employee satisfaction (sharing decisions with employees), and culminates in accomplishment of organizational goals, reduces on stress and conflict but promotes and encourages organizational goal attainment, commitment, and acceptance of change.

In Table 4.1, the study sought to establish the extent to which Performance Appraisal practiced at the university helped identify areas to improve employee skills. 2.0% of the respondents strongly disagreed, 2.0 % disagreed, 2.3% were not sure, 16.7% agreed and 77.0% strongly agreed that Performance appraisal practiced at the university helped identify areas to improve employee skills. Generally, 4.0% Of the respondents disagreed, 2.3% were not sure, while 83.7% agreed that Performance appraisal practiced at the university helped identify areas to improve employee skills. This study complied with Prowse and Prowse (2009); Wilson and Western (2001) who revealed that appraisal is a tool for improving individual employees in attainment of university/organizational goals by helping managers to execute effective management. Appraisal should therefore be conducted frequently according to set goals. The sentiments echo goal setting theory which stipulates that the learners must agree on and accomplish the set goals on time (Locke & Latham 2006).

The study sought to establish the extent to which employees get interviewed immediately after training. 5.7% of the respondents strongly disagreed, 9.2% disagreed, 2.7% were not sure, 52.9% agreed while 30.5% strongly agreed. Generally, 14.9% of the respondents disagreed, 2.7% were not sure, while 83.4% of the respondents agreed that employees get interviewed immediately after training. This study agrees with the works of Anna and Bierstaker (2009); Ohman and Svanberg (2013); Stewart and O'Leary (2011) who all posit that there is a general belief that feedback can improve performance although not much evidence has been envisaged.

The study sought to establish the extent to which employees always completed filling questionnaires after training, and the trainer gave immediate reports. 5.2% of the respondents strongly disagreed, 2.3% disagreed, 2.9% were not sure, 58.0% agreed, while 31.6% strongly agreed that employees always complete filling questionnaires after training, and the trainer gives reports immediately. Generally, 7.5% disagreed, 2.9% were not sure, and 89.6% agreed that employees always complete filling questionnaires after training, and the trainer gives immediate reports.

The study sought to establish the extent to which the trainer conveys his observations timely after training. 7.5% of the respondents strongly disagreed 4.0% disagreed, 1.7% were not sure, 43.1% agreed, 43.7% strongly agreed that the trainer conveys his observations timely after training. Generally, 11.5% disagreed, 1.7% was not sure, 86.8% agreed that the trainer conveys his observations timely after training. The study realized that successful assessment for learning strategies result in improved learner progress on a continual basis and the value of the feedback is dependent on the quality of the feedback, and how learners receive and ultimately use it.

The study sought to establish the extent to which results of performance appraisals have greatly helped employees undergo various trainings in the university. 9.8% of the respondents strongly disagreed, 4.0% disagreed, 4.0% were not sure, 42.5% agreed, while

39.7% strongly agreed. Generally, 13.8% of the respondents disagreed, 4.0% were not sure, while 82.2% agreed that results of performance appraisals have greatly helped me to undergo various trainings in the university. Managers across the University already support staff to take paid time off to attend staff training and development activities such as courses, workshops and conferences.

The study sought to establish the extent to which employees are usually given evaluation reports in relation to the knowledge, skills and competencies acquired after training. 3.0% of the respondents strongly disagreed, 5.0 % disagree, and 3.0% were not sure, 37.0 % agreed, while 52.0 % strongly agreed that employees are usually given evaluation reports in relation to the knowledge, skills and competencies acquired after training. Generally, 8.0% disagreed, 3.0% were not sure, while 89.0% agreed that employees are usually given evaluation reports in relation to the knowledge, skills and competencies acquired after training. The study is in agreement with Mullins (2010) who stated that results of evaluation of training would consider the extent to which the training contributed to enhanced organizational performance, effectiveness, quality and prospects of employees. When employees are deemed to be competent, then automatically, their skills and knowledge are acceptable for the required, expected and improved performance.

The study sought to establish the extent to which employees after training, discuss their interview results with their trainer. The study revealed that 10.0% of the respondents strongly disagreed, 9.0% disagreed, 19.0% were not sure, 19.0% agreed, and 43.0% strongly agreed that employees after training discuss their interview results with their trainer. Generally, 19.0% disagreed, 19.0% were not sure, and 62.0% agreed that employees after training discuss their interview results with their trainer. The environment of Andragogy must be safe and there should be a sound relationship between trainer and learner for convenient learning and development (Jones, 2016). The learner and trainer are both involved in creating the learning experience and ensuring that learning occurs (Knowles, 2013).

**Table 4.1: Training Feedback**

	SA	A	NOT SURE	D	SD	Total %
Performance Appraisal practiced at the university helped identify areas to improve my skills	77.0	16.7	2.3	2.0	2.0	100
I always get interviewed immediately after training	30.5	52.9	2.7	9.2	5.7	100
Observations made during training sessions improved my performance	58.6	35.0	2.3	2.3	1.8	100
I always complete filling questionnaires after training, and the trainer gives immediate reports	31.6	58.0	2.9	2.3	5.2	100
The trainer conveys his observations timely after training	43.7	43.1	1.7	4.0	7.5	100
Results of Performance appraisals have greatly helped me to undergo various trainings in the university	39.7	42.5	4.0	4.0	9.8	100
I am usually given evaluation reports in relation to the knowledge, skills and competence acquired after training	52.0	37.0	3.0	5.0	3.0	100

After training I appreciate discussing 43.0 19.0 19.0 9.0 10.0 100

my interview results with the trainer training

#### 4.2 Descriptive Statistics on Training Feedback

Table 4.2 highlights the respondents' views on training feedback. The statistics show that the respondents viewed performance appraisal as a way to improve skills (Mean = 4.76, SD = 0.47). Most organizations conduct a performance appraisal specifically to gauge performance deficiency from the employee. This performance deficiency can be due to lack of skills or skills mismatch and thus appraisal measures detect these anomalies. Once appraised, the individual will know the level of skill deficiency.

Employees prefer to get interviewed immediately after training (Mean = 3.95, SD = 1.09). A feedback after training serves to alert the trainer of the training gaps or effectiveness of the training to the individual employee. The feedback may be in the form of suggestions, questions and follow-ups from an interview

The employees would also prefer to be observed and observation reports shared with them for improving performance. (Mean = 4.54, SD = 0.64). Feedback in the form of observational reports improves productivity and performance.

Statistics show that the respondents get evaluation reports in relation to knowledge, skills and competencies after training (Mean = 4.10, SD = 0.94). The respondents alluded to the fact that the presence of training policy assisted in matters touching on training (Mean = 3.99, SD = 1.22). A good training policy would help govern the training agenda within the organizations. Lack of it would likely lead to skill deficiency, skills mismatch and haphazard training regimes. Most employees affirmed that they were comfortable with their jobs and that the training acquired adequately prepared them for challenging duties. This shows that the training they received gave them relevant skills that match the jobs demand.

There appropriate ways suggested by respondents were; improvement in working condition, specialized training (skills deficiency), promotion, recognition, remuneration and incorporation in decision making. From the answers given, it can be deduced that there are many underlying structural issues affecting the respondents; which may include the workplace design which affected the ergonomic aspect at work place, skills deficiency on those who required specialized training, and their being incorporated in decision making.

**Table 4.2: Descriptive Statistics on Training Feedback**

	N Statistic	Mean Statistic	Std. Deviation Statistic
Performance appraisal improves skills	173	4.7572	.46882
I always get interviewed immediately After training	173	3.9535	1.0887
Observation made during training	173	4.5407	.63391
Sessions helped improve performance			
I am usually given evaluation	173	4.1047	.93695
Reports in relation to knowledge, skills and competencies after training			
Time allowance for reflection learning	173	4.1214	1.13212
Training policy help in training	173	3.9942	1.2211

## 4.2 Conclusion

The study revealed that training feedback plays a significant influence on the performance of non-teaching employees at management level in selected public universities in Kenya. Most of the respondents agreed that appraisal practiced at universities helped identify areas to improve skills. The study therefore established that employees required frequent feedback; as positive reinforcement was the most desired and effective form of feedback.

## 4.3 Recommendations

Public Universities must give timely training feedback to employees after attending trainings. Delayed feedback is of no use to employees. Feedback should be relayed with caution and in a humane manner to encourage positive reception and taking of action.

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# ANALYSIS OF THE EFFECT OF MODE OF TRAINING ON THE PERFORMANCE OF NON-TEACHING MANAGEMENT EMPLOYEES AT SELECTED PUBLIC UNIVERSITIES IN KENYA

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**Abstract-** This study aimed at analyzing the effect of mode of training on the performance of non-teaching management employees in selected public universities in Kenya. The study was conducted in eight of the twenty-two public universities in Kenya with a sample size of 176 non-teaching employees. The study was both qualitative and quantitative. Qualitative due to descriptive statistics which were used in interpreting data and, quantitative due to data obtained from questionnaires that was interpreted using statistical packages like SPSS V 20, and Stata V12, and analysis was done by regression and correlation. The study used open and closed ended questionnaires and a Likert measurement scale of 1 to 5. The study results revealed that Mode Training ( $p$  value = 0.001) was statistically significant and therefore had influence on the performance of non-teaching employees at selected public universities in Kenya.

**Key Words-** Training, Performance, Non-Academic, Mode of Training

## 1. INTRODUCTION

According Truitt (2011), organizations can adopt various HRM practices such as training to enhance employee skills. Efforts can focus on improving the quality of the individuals hired, or on raising the skills and abilities of current employees, or on both. Product innovation and product quality can be positively affected by training (Katou & Budhwar 2007). In support of this, a study by Azara et al. (2013) affirmed significant and positive association between training and development of new products and trustful relationship. Furthermore, an empirical assessment on the relationship between human resource practices and firm performance in Malaysia-(Osman et al., 2011) also acknowledged that training contributes significantly to the performance of an organization, implying an affirmative link sandwiched between human resource systems and organizational performance.

Employee training is an envied undertaking in the university, and it is believed that training will aid performance output due to acquired skills, technology and knowledge (Odinga, 2010). Organizations that extensively train their employees create a reputation for valuing and developing employees and are able to attract a cadre of highly skilled employees (Kipkebut, 2010). It is imperative that the institutions of higher learning or businesses whose goals are to survive and prosper invest in training and development to improve production and acquire great returns in the investment of human capital (Truitt, 2011). Human capital model is based on the premise that additional non-compulsory training increases the productivity of labor in a perfectly competitive market (Omolo, 2014).

According to Akala (2010), training is crucial for the development of non-teaching employees. HR activities such as job training, coaching, mentoring, counseling, and general career development enable employees get support, knowledge, abilities that promote chances of being employed, and remain marketable. Employability includes skills, knowledge and competencies that enhance a worker's ability to secure and retain a job, progress at work and cope with change, secure another job if he or she so wishes or has been laid off, and enter more easily into the labour market at different periods of his or her lifecycle (Franz & Omolo, 2014).

Training is well suited for making clear contribution to enhance human well-being and performance in work places and society as a whole. American Society for Training and development spent over 126 Billion dollars annually on employee training and development (Aquinis & Kraiger, 2009). In recent years, American companies have been encouraged to embrace a variety of performance-enhancing or progressive human resource management (HRM) practices such as training; so as to improve their competitiveness in the global marketplace (Mitiku, 2015). Weil & Woodland (2005) argued that training falls under HRD function

which has been agreed to be an important function of HRM. HRM activities are considered as a gift in the eyes of employees and training is one of them (Mahbuba, 2013).

Training of employees in universities, increases productivity through better job performance, more efficient use of human resources, attainment of goals and objectives, reduced costs due to less labor turnover, reduced errors, reduced accidents and absenteeism, more capable workforce and retention of existing staff (Ongori & Nzozzo, 2011). Similarly, Echard and Berge (2008) observed that effective training techniques can produce significant business results especially in customer service, product development and capability in obtaining new skills. He continues to argue that linkage of training to business strategy has given many businesses the needed competitive edge in today's global market. Training also improves the culture of quality business workforce and final product (Ongori & Nzozzo, 2011). This argument has been confounded by Roomi et al. (2009) who stated that training is mainly geared towards building entrepreneurial skills and traits of the recipients in order to better their businesses practices

Training is of benefit both to employee and the organization. In this case, training becomes an opportunity leading to promotion, self-improvement, job satisfaction, better job performance, a chance to learn new things and greater ability to adapt and cope with change (Ongori & Nzozzo, 2011). Dessler (2005) continues to state that once a decision of training is made and training needs and goals have been identified, then designing of training programs should follow. Failure to conduct training need assessment or identification of skill deficits leads to poor performance; as conferred by Ongalo and Tari (2015), who argued that Kenya electricity generating and distribution firms lacked clear policies governing training and development and this had a negative effect on organizational performance.

According to a study by Guerrero and Sire (2001), comprehensive training design structure is capable of improving productivity and encouraging better product performance and quality. Additionally, Obisi (2011) in his paper 'employee training and development in Nigerian organizations, emphasized that organization should properly evaluate their training program so that their organization objectives and missions are achieved. Training can not only change the ability of workforce in performing their current job but also aids them in the fulfillment of future expected task.

The organization may use on the job or off the job training methods and the trainers may be sourced from in-house or externally or use a combination of both sources. Tukunimulongo (2016) study on Mumias Sugar deduced that on-the-job-training programs enhance employee performance in public organization. Similar findings were also observed by Kasau (2014) who argued that training is central in determining employee performance especially in service firms under which micro-finance institutions fall. The research further confirmed that training has a big influence on performance with attitude, job satisfaction and service delivery equally getting the same weight.

## 2. LITERATURE REVIEW

The social learning theory lays emphasis on the fact that people learn by observing what other people do especially those they believe are credible and knowledgeable (Bandura, 2013). This theory maintains that behavior that is reinforced or rewarded will always recur. In addition to motivating behavior by directly rewarding it, a person may perform behavior that he observes another having been rewarded for (extrinsic reward), and he may learn to reward himself for the appropriate behavior. The model skill that is rewarded is adopted by the observer. In this model, acquisition of new skills or behavior arises from either direct experience or by observation.

Job Rotation was developed in Denmark in the 1980's and has been defined as systematic movement of employees from one job to another at planned intervals (Dessler & Varkkey, 2009; Malinski, 2002). Job Rotation is the process through which organization employees' work as displacement at different homogenous levels (Nafei, 2014). Adjei (2012) defines job rotation as a succession planning tool that enhances skills and legacy of the organization while working to retain younger employees who increasingly demonstrate desires to learn and experience new things. Implementing job rotation, diversifying job skills, minimizing monotony and thus increasing motivation result in employees' personal achievement, higher output, decreased absence rate and higher level of acceptance (Abbasi et al., 2013)

Odhong (2015) stated that, job rotation at the senior management levels is frequently referred to as management rotation. It is tightly linked with succession planning for instance, developing a pool of people capable of stepping into an existing job. Here the goal is to provide learning experiences which facilitate changes in thinking and perspective equivalent to the "horizon" of the level of the succession planning.

Leat (2007) and Campion (2001) claim that rotating an employee from one department to another is not a luxury but a necessity of today's professional climate as it provides an intermittent opportunity to employees to tackle higher-level diversified tasks which bring about greater job interest/motivation and involvement among them and subsequently enhance their job performance. Job rotation also improves employee's problem-solving abilities and shared understanding of the job and enhances team efficiency (Mohsan et al., 2012).

According to Rhaman et al. (2011), skill can be passed on using lectures, as he maintains that lecture method is basically narration that will signify what we usually call explanation or description. According to Walker (2003) there are three main reasons for using the lecture format for instance to transmit information, to create interest, and to promote understanding. According to Rahaman (2011), lecture method can be used to effectively survey the structure of knowledge in a particular area as well as suggest the connection between cases and real decision-making. This mode of training reaches trainees at an emotional level, and provides necessary motivation for learning difficult material.

Computer Based Learning also known as Computer Aided Instruction refers to the use of computers as a key component of the educational environment. While this can refer to the use of computers in a classroom, the term more broadly refers to a structured environment in which computers are used for teaching purposes. Computer-Based learning has many benefits; including the advantage of users learning at their own pace and also learning without the need of an instructor to be physically present (Julia et al. 2009). Chambers et al., (2008) findings revealed that computer assisted instruction is an effective tool for increasing performance.

According to Harris et al. (2007), apprenticeship involves teaming up apprentices with a knowledgeable, skilled adult worker (a mentor) who guides and assists the apprentice in skill and knowledge acquisition. The second means of acquisition of new skills is through observation. Observation is the action or process of examining something or someone in order to gain information and can be through simulation or role play.

Recent advances in technology have positioned simulations as a powerful tool for creating more realistic, experiential learning environments and thereby helping organizations meet these emerging training challenges (Bell et al., 2008). Bell et al. (2008) defines a simulation as an exercise involving reality of function in a simulated environment. They further note that an essential feature of simulations and other synthetic learning environments (e.g., virtual reality) is the ability to augment, replace, create, and/or manage a learner's actual experience with the world by providing realistic content and embedded instructional features.

Like other types of distributed learning systems, simulations allow training to occur almost anywhere and anytime, and this flexibility can be used to reduce or eliminate many of the variable costs associated with traditional training, such as classrooms and instructors (Summers, 2004). Simulations also possess unique features that create the potential for instructional benefits not offered by other instructional mediums. For example, simulations can be used to create a synthetic- or micro-world that immerses trainees in a realistic experience and exposes them to important contextual characteristics of the domain (Schiflett et al., 2004)

Simulations can also be used as realistic practice Simulation-Based environments for tasks that are too dangerous to be practiced in the real world or to provide opportunities for practice on tasks that occur infrequently Bell et al. (2008). A growing body of literature suggests that simulations can serve as effective training tools. Washbush and Gosen (2001), for example, identified a total of 11 well-designed experimental studies of business simulations and concluded that the use of simulations improved learning by an average of 10% on pre- and post-training knowledge assessments. Bell et al. (2008), included quasi-experimental studies in his review, but reached a similar conclusion that simulation gaming produced better learning than the use of business case studies. Bell et al. (2008) in their recent review of synthetic learning environments noted that simulations have been shown to be effective in a variety of contexts, including the training of pilots, clinicians, military personnel, fireman, and survey interviewers. A number of studies have also shown that in addition to enhancing learning outcomes, individuals generally report positive reactions.

The role-playing process provides a live sample of human behavior that serves as a vehicle for employees to explore their feelings, gain insights into their attitudes, values, and perceptions; to develop their problem-solving skills and attitudes; and explore subject matter in varied ways (Lynn et al., 2015). According to Henriksen (2004) role-play is a medium where a person takes up a role and, is given the opportunity to participate, and interact with the contents thereof and its participants. Seaton, Dell'Angelo, Spencer, & Youngblood (2007) suggest the use of role-play to help in the development of self-awareness, self-regulation, and self-monitoring. However, Karwowski and Soszynski (2008) describe role-play as an activity where a limited number of learners take on specifically assigned and well defined roles, act out an encounter that involves a goal or problem and denotes a cluster of prescribed behaviors associated with particular positions.

Many researchers have discussed the successful use of role-play as a training tool in many different scenarios Svinicki & McKeachie (2011). In a Finnish study of role-playing games, Meriläinen (2012) describes the self-reported social and mental development of role-players. Specific skills that can be gained by role-play include modifying one's performance in light of feedback, becoming a good listener, showing sensitivity to social cues, managing emotions in relationships, and exercising assertiveness, leadership, and persuasion (Lynn et al., 2015). Karwowski and Soszynski (2008) used role-play successfully to train undergraduate students in creativity, but they also believed it developed a capability for constructive criticism. Lynn et al. (2015) suggest role-playing is an appropriate strategy to facilitate employee's active involvement in learning.

Svinicki and McKeachie (2011) view the chief advantage of role-playing to be that employees are active participants rather than passive observers and therefore must make decisions, solve problems and react to the results of their decisions. Dell'Olivo and Donk (2007) believe that role-playing helps employees make responsible autonomous choices because it provides a forum for exploring

multiple ways of acting and reacting in a given situation. Hall, Quinn and Gollnick (2008) on the other hand state that experiences gained through role play can take the place of firsthand experiences that may be impossible to otherwise achieve. They further explained that participants often cite such experiences as the most informative and influential part of their training.

Apprenticeship is another form of on the job training, in which a master craftsman imparts skills on learners under his or her supervision. This type of training was commonly found among professionals such as Doctors, dentistry, law, and teaching and was not a preserve for artisans. Both classroom and job experiences are contained in apprenticeship and may require long period under experts guidance in order for trainees to gain proficiency.

Employees will therefore be motivated by confidence and success of their peers, and past accomplishment where employees are allowed to build a history of successful accomplishments. Employees may be placed in situations where they are likely to succeed and provide training so that employees know what to do and how to do it. The processes that can be revealed through Social Learning theory are attention, retention and motor reproduction.

People cannot learn by observation unless they are aware of important aspects of a model's performance. Attention is influenced by characteristics of the model and the learner. Learners must be aware of the skills or behavior they are supposed to observe. The model must be clearly identified and credible and, the learner must have the physical capability (sensory capability) to observe the model (Noe, 2010). A learner who has been successful in learning other skills or behavior by observing the model is more likely to attend to the model. Learners must remember the behaviors or skills that they observe. Learners have to code the observed behavior and skills in memory in an organized manner so that they can recall them for the appropriate situation. Behaviors or skills can be coded as visual images (symbols) or verbal statements. Motor reproduction involves putting in practice the observed behavior to ascertain they culminate in the same reinforcement that the model received. Recalling of behavior and skills is an indication that the learner can reproduce them. Performance of behavior may lack perfection on the first attempt. Practice and feedback are important components which help behavior to be like that of the model (Noe, 2010).

Learners enjoy and adopt modeled behavior whose results are positive. Social learning theory emphasizes that behaviors that are reinforced (a motivational process) are likely to be repeated in future. Use of employee participation during appraisal may reveal some positive rewards to employees who will enjoy the appraisal and make the manager apply the same other times.

Studies by Brum (2007) revealed that training has an integral part to play in socialization of employees. Employees can also learn by watching, observing others, and, by imitation (Mullins, 2010). Thus, the process relies on complex, cognitive processes, which encompass attention, recall, and understanding. The trainee requires individual intelligence, judgment and skill in order to repeat the behavior. We must admit that behavior has its pros and cons and may not conclusively explain certain forms of learning. Bandura (2013), and Wenger (2006), reveal that learning occurs through social interactions, which they refer to as community practice as groups of experts working together.

## 2. METHODOLOGY

The study adopted the Survey design and Correlation research designs. Survey strategy allows collection of quantitative data which can be analyzed quantitatively by use of descriptive and inferential statistics.

Mugenda and Mugenda (2003), also indicates that Correlation research design is basically concerned with assessing relationships among variables. It is thus based on the premise that if a statistically significant relationship exist between two variables, then it is possible to predict one variable using the information available on another variable.

The sampling method was chosen according to Kothari (2008), who maintain that stratified random sampling helps to achieve intended representation from various sub-groups in any given population, and guarantees minimal bias. In the study, the population was divided into meaningful, subsets that do not overlap and, the subjects were chosen from each subset. The study used stratified random sampling because the population is heterogeneous. The total population of non-teaching employees in the target population was 450.

The Sample given was statistically determined using the indicated formula, since the total population was less than 10,000 (Mugenda & Mugenda, 2003).

$$n = \frac{z^2 p q}{d^2}$$

Where:

n= the desired sample (if the population is greater than 10,000).  
z= the standard normal deviate at the required confidence level  
p=the proportion in the target population estimated to have characteristics being measured.  
q=1-p  
d= the level of estimated significance set.

For instance, a target population with a characteristic .50, the z - statistic is 1.96, and desired accuracy at 0.05 level, the sample size will be:

$$n = \frac{(1.96)^2 (.50) (.50)}{(0.05)^2} = 384$$

In this case, the target population was less than 10, 000, and the required sample size were smaller. To get the sample size therefore, the formula given by Mugenda and Mugenda (2003) has been adapted in this study.

$$nf = n / (1 + n)/N$$

Where:

nf= desired sample size when the population is less than 10,000  
n = desired sample size when population is more than 10,000  
N= the estimate of population size

For instance:

$$\begin{aligned} &= 384 / (1 + 450) / 384 \\ &= 384 / 1 + 1.17 \\ nf &= 176 \\ \text{Percentage} &= 176 / 450 * 100 = 39\% \end{aligned}$$

The study worked with 39%. Mugenda and Mugenda (2003) recommend that 10% of the accessible population is adequate, and at least 30 cases are required per group, for statistical data analysis.

The accessible population or the respondents were drawn from the 8 out of the 22 public universities in Kenya. A sample of (36%) 8 public universities out of the total 22 public universities were selected for the purpose of this study. The study used Non-probability sampling specifically purposive sampling technique to select the 176 non-teaching staff in management level at public universities. Table 3.1 below illustrates the sampling frame developed by the researcher of the 8 selected public universities operating in Kenya.

**Table 3.1 Sample Frame**

Name of selected public university	No of Non-Teaching Employees at management level	Grades of the Non-Teaching Employees at management level			Sample Size
		13	14	15	
JKUAT	67	11	11	5	27
KU	65	12	11	4	27
MOI	63	11	10	3	24
Eldoret	50	9	8	3	20
UoN	66	11	11	3	25
Egerton	54	9	9	2	20
Maseno	35	5	5	3	13
MMUST	50	9	8	3	20

<b>TOTAL</b>	<b>450</b>	<b>77</b>	<b>73</b>	<b>26</b>	<b>176</b>
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A structured questionnaire was used to obtain the data. A Pilot study of 10% (17 respondents) of the desired sample size of 176 respondents will be carried out at Kenyatta University, Nairobi University and Jomo Kenyatta University. According to Mugenda and Mugenda (2003) the purpose of the pilot study is mainly to pretests the instrument to ensure that the items in the instrument are stated clearly and have the same meaning to all the respondents. The pretest enabled the study asses the clarity of the instrument and asses the time taken to administer the instrument. The reason for choice of 3 universities: Kenyatta, Nairobi and Jomo Kenyatta University of Agriculture and Technology is because they have similar characteristics and features as the other universities in Kenya. The pretest was subjected to the internal consistency technique using the Kuder-Richardson (K-R) 20 Formula which is as follows:

$$KR20 = \frac{K(S^2 - \sum s^2)}{S^2(K-1)}$$

Where:

KR20= Reliability coefficient of internal consistency

K = Number of items used to measure the concept

S<sup>2</sup> = Variance of all scores

s<sup>2</sup> = Variance of individual items

A high coefficient will imply that items correlate highly among themselves indicating that there exists consistency among the items in measuring the concept of interest (Mugenda & Mugenda, 2003).

Data was analyzed using quantitative analysis. The first step described and summarized the data by use of descriptive statistics. This enabled the researcher to meaningfully describe the distribution of results depending on the variables in the study and the scale of measurements used. Descriptive statistics such as Measures of central tendency (Mean, Mode and Median) and Measures of variability (range, standard deviation, frequency distribution, histograms, frequency polygons, bar charts, percentages and relationships) was used in analyzing the data. Inferential statistics on the other hand was used to make inferences about the population based on results obtained from samples. In this study, the researcher used regression and correlation tests which attempted to establish the relationship between independent variables and the dependent variable. The questionnaires were coded and the data was keyed into the computer using Statistical Package for Social Science (SPSS V-17) as well as STATA (10/12) Statistical Software. The statistical softwares were used to analyze both descriptive. The results were presented using charts, graphs and tables.

#### 4. RESEARCH FINDINGS, ANALYSIS AND DISCUSSIONS

##### 4.1 Mode of Training

Figure 4.1 indicates that, more than half 52% of the individuals attended induction training more than any other type of training. This number is followed by those who attended management training at 29.3% with further 9% having attended technical training. Skills presentation as a type of training has been attended by 10.3% of the study respondents. The results are largely attributed to the fact that each individual had to attend induction training at the time of appointment and the nature of exclusivity of the management training.

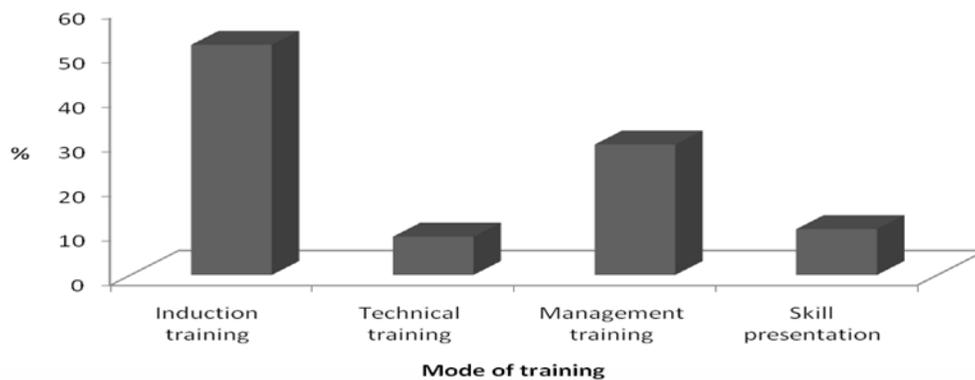


Figure 4.1: Mode of Training

#### 4.2 Respondents views on Mode of Training from Likert scale

In Table 4.1, the study sought to establish the extent to which performance improved after attending training. 1.7% of the respondents strongly disagreed that performance improved after attending the job training, 1.7% disagreed, 1.7% were not sure, 61% agreed, while 33.9% strongly agreed that performance improved after attending on the job training. Generally, 4.0% of the respondents disagreed, 1.7% was not sure, and 94.9% agreed that performance improved after attending training. The study concurred with findings by Shah et al. (2014) who alluded that programs which are developed according to the training need assessment and keeping in mind the organization's short & long term objectives help improve performance. It has been proved through various researches that training has a positive influence on employee performance, although, there may be other HR factors that boost performance. Employees who are exposed to proper training are likely to perform better than those who did not attend any training (Brum, 2007).

The study sought to establish the extent to which on the job training helped employees at the university in operations. 4.0% of the respondents strongly disagreed, 4.1% disagreed, 4.6% were not sure, 27.0% agreed and 60.3% strongly agreed. Generally, 8.1% disagreed, 4.6% were not sure and lastly 87.3% agreed that the on the job training helped employees at the university in operations. The study agreed with Jagero Komba and Mlingi (2012) who revealed that employee training involves teaching employees skills which will make them efficient and productive to the employer. Most employees undergo on the job training during their careers, thus they accrue some benefits as well as the employers. Training is often conducted to familiarize new employees with the roles and responsibilities of their positions as well as company policies. Many companies offer continuing training opportunities for employees, focusing on skills that can improve efficiency. Armstrong (2009) contends that trained employees often work better as teams because everyone is aware of the expectations and can achieve them together smoothly. Trained employees are also more confident in their performance and decision-making skills.

The study sought to establish the extent to which Computer-based knowledge acquisition helped non-teaching employees to undertake bigger quantity and better quality of work in the public universities in Kenya. 1.1% of the respondents strongly disagreed, 4.6% disagreed, 1.1% was not sure, 42.0% agreed, and 51.2 % strongly agreed. Generally, 5.6% of the respondents disagreed, 1.1% was not sure, and lastly, 93.2% agreed that Computer-based knowledge acquisition helps non-teaching employees to undertake bigger quantity and better quality of work in the public universities in Kenya.

The study agrees with Elnaga and Imran (2013) who maintained that effective training helped employees to get acquainted with desired new technological advancement, gain full command on competencies and skills required to perform a specific job and reduce on mistakes. Elnaga and Imran (2013) reveal that there are varied ways of overcoming the employee performance gap, therefore, through training; employees may develop skills, competencies and ability leading to individual employee performance improvement and organizational productivity. Armstrong (2009) confirmed that new technology has overtaken employees' jobs. Dabale, Nyauchi and Jagero (2014) revealed that employees need to train in use of technology to remain relevant.

The study sought to establish the extent to which lecture notes obtained during training help non-teaching employees as future reference materials in the course of their work. 10.9% of the respondents strongly disagreed, 6.9% disagreed, 9.2% were not sure, and 31.6% agreed, while 41.1% strongly agreed. Generally, 17.8% disagreed, 9.2% were not sure, and 73.3% agreed that lecture notes obtained during training help non-teaching employees as future reference materials in the course of their work. A lecture may involve talking by the facilitator, and the trainees may be required to listen and take notes, while answering questions when necessary. Lecture method is a means of transferring of information to learners (Armstrong, 2009). The visual aids used during lectures may prove helpful to the learner after training. The study therefore confirmed that materials used during lectures are of great benefit to employees.

The study sought to establish the extent to which non-teaching employees enjoy comfort at university work places after induction training. 1.9% of the respondents strongly disagreed, 1.7% agreed, 1.8% were not sure, 36.0% agreed, and 58.0% strongly agreed that non-teaching employees enjoy comfort at university work places after induction training. Generally, 3.6% disagreed, 1.8% was not sure, and, 94.0% agreed that non-teaching employees enjoy comfort at university work places after induction training. This implies that induction helps non-teaching employees to settle at work, familiarize with work environment, and the associated tasks. The HRM, the supervisor, or the team leader may address the new employees. The department heads may also address the new employee regarding immediate duties, and introduce them to the department. The employee may thereafter settle to perform assigned duties or proceed on further training, hence the study agrees with (Armstrong, 2009).

The study sought to establish the extent to which role playing improved learning during training offered away from the university. 51% of respondents strongly disagreed, 8% disagreed, 11% were not sure, 15.8% agreed, and 14.2% strongly agreed. Generally, 59% of the respondents disagreed, 11% were not sure, and 30% agreed that employees at the university, concentrated better during off- the-job training. The study clearly indicates that more than half of the respondents disagreed, implying that there may be other factors that may determine better concentration when employees are training away from the university premises. This may be due to dependence on balance between what may be considered as theoretically desirable and what participants understand as practically possible to implement (Mullins, 2010).

The study sought to determine the extent to which simulation benefited employees in the course of performing their duties. 22% of the respondents strongly disagreed, 18% disagreed, 10% were not sure, 7% agreed, while 43% strongly agreed that simulation trainings attended benefited employees in the course of performing their duties. Generally, 40% of the respondents disagreed, 10% were not sure, while 50% strongly agreed. The study concurred with Mullins (2010) who eluded that management development for instance simulation entails dual function of improving effectiveness of individual managers and improving management performance as a whole and organizational effectiveness. Therefore, an integrated approach is to be adopted regarding the development of the entire organization. Lastly all managers require continual enhancement of their professional competence (Armstrong, 2009).

The study sought to determine whether job rotation helps employees to master operations in most divisions within the universities. 10% of the respondents strongly disagreed, 11% disagreed, 21% were not sure, 5% agreed and 53% strongly agreed that job rotation helped employees to master operations in most divisions within the universities. The study agrees with Dessler (2005) who stated that employees learn a lot from job rotation experiences; for instance, varied job exposures and the realization that all departments are equally important for the success of the university/organization. Mullins (2010) asserts that job rotation can be used for up skilling in areas which require new technology, within departments inform of cross-training and in cases where an employee has been promoted or transferred to another section.

The study sought to establish whether apprenticeship is a better method of transfer of skills and knowledge to employees. The study revealed that 8% of the respondents strongly disagreed, 10% disagreed, 17% were not-sure, 30% agreed, while 35% strongly agreed. Generally, 18% disagreed, 17% were not sure, and 65% of the respondents agreed that apprenticeship is a better method of transfer of skills and knowledge. ILO-Steedman, (2014) posit that employment services expand peoples' awareness of apprenticeship and the kinds of jobs they can perform.

**Table 4.2: Mode of Training**

	SA	A	NOT SURE	D	SD	Total %
On the job training helped me improve my performance	33.9	61.0	1.7	1.7	1.7	100
On the Job training helped me in operations	60.3	27.0	4.6	4.1	4.0	100
Computer-based knowledge acquisition	51.2	42.0	1.1	4.6	1.1	100
Helps undertake bigger quantity and better quality of work						
Knowledge acquired from lectures during on the job training Improves performance	42.0	52.9	2.3	1.1	1.7	100
Reference materials from lectures help in work execution	41.4	31.6	9.2	6.9	10.9	100
Induction after training led to comfort in executing duties at work	58.0	36.0	1.8	1.7	1.9	100
Role playing improves my learning during training offered away from the university	14.2	15.8	11	8	51	100
Simulation benefitted me in the course of performing my duties	43	7	10	18	22	100
Job rotation has helped me to master operations in most of the divisions in the university	53	5	21	11	10	100
Apprenticeship is a better method of transfer of skills and knowledge to employees	35	30	17	18	8	100

**4.3 Descriptive Statistics on Training Mode**

Table 4.3 focused on specific aspect of on-the job training which ranged from computer based training, job rotation, lectures, simulation and role play. The descriptive statistics shows that job training serves three objectives; improvement in operations, knowledge acquisition and performance improvement. The respondents affirmed that their performance improved after training (Mean = 4.27, SD = 0.66), there was an improvement in operations (Mean = 4.37, SD = 1.01) and that they acquired knowledge during the training lectures (Mean = 4.33, SD = 0.72). This implies that the training being offered was geared towards knowledge and skill acquisition and towards the improvement of individual and organizational performance. Another aspect of on job training is the computer – based knowledge acquisition which is touted as a solution to the work place job performance. Organizations investing in IT with the hope that it will lead work place efficiencies but such investment require the prerequisite investments in the human aspect

of IT in order for the information systems to serve its purpose. The respondents affirmed that the training in IT (Mean = 4.39, SD = 0.78) is important as it is a prerequisite to the investments in IT.

In general, the organization offers a variety of training ranging from induction training through lectures to role play at management level. In between there are a variety of training geared towards specific objectives and outcomes. The employees tend to feel the job rotation after training (Mean = 4.55, SD = 0.68) and that simulation is an important aspect of improving performance (Mean = 4.51, SD = 0.57). At entry level, most employees hold prerequisite educational level but lack the critical skills to undertake their jobs and thus the need for job rotation to equip them with the job skills. Similarly, simulation is critical to individuals who are promoted or hired to management positions. They may have the technical skill, but may lack in the person management skill and thus apprenticeship is offered to them to help them cope with the increase in responsibilities.

Computer – based learning is a technique that is used in training workforce with an emphasis on the use of IT. As per the responses, the benefits of computer –based learning range from training and communication, information access and storage, work efficiency, improved use of new technology, computer skills acquisitions, communication and conferencing. Majority of the respondents felt that IT improves information access and storage and thus it aids in training and communication, improvements in the use of new technology and computer skills acquisition.

According to respondents, the other HRM strategies that might be used include open door policy, interpersonal relationship, employee welfare, and improvement in working conditions and motivation (incentives, better pay and allowances). The responses illustrated that HR policies at work place were not effective enough to be felt by the employees and thus the need to focus on employee motivation in terms of incentives, better pay, allowances and employee welfare in terms of insurance. Other issues raised include the improvement in working conditions and open door policy.

**Table 4.3: Descriptive Statistics on Training Mode**

	<b>N Statistic</b>	<b>Mean Statistic</b>	<b>Std.Deviation Statistic</b>
On- the- job training helped me improve performance	173	4.2659	.66371
On the Job training helped in operations	173	4.3699	1.01249
Computer based knowledge acquisition	173	4.3931	.78233
Knowledge acquired from lectures improves performance	173	4.3353	.71753
Reference materials help in work Execution	173	3.8613	1.32654
Job training led me to master operations in most of the divisions in the university	173	4.5491	.67700
Simulation benefitted me in the course of performing my duties	173	4.5087	.56670

#### 4.4 Conclusion

The study revealed that mode of training had played a significant influence on non-teaching employee performance at management level in selected public universities in Kenya. Most of the respondents agreed that performance improved after training while on the job training helped in operations, as computer based knowledge helped them to undertake bigger quantity and quality of work. Depending on the mode of training, employees acquired knowledge that improved their performance. Job rotation helped employees

to master operations in most departments within the university, enabling employees to work with ease in any department. Where possible for senior technical staff, apprenticeship promoted transfer of skills and knowledge to employees through participation and observation.

#### 4.5 Recommendations

Various training methods in the study were widely used in most public universities in the study. However, public universities must recognize the effect of globalization and step up computer/web based training/awareness to all employees, in order to survive in this competitive era. Job rotation should not be used as a punishment but it should be done in a way that is appealing, knowing employees would benefit from exposure to many departments.

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# DETERMINANTS OF DURABILITY OF RURAL ROAD NETWORK IN UGUNJA SUB-COUNTY, SIAYA COUNTY, KENYA

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**ABSTRACT:** This study was carried out to assess the determinants of durability of road networks in the rural setting of Ugunja Sub-County in Kenya. This study was anchored by the constraint theory. The target population of the study was 120 employees of Kenya rural road authority, 180 road side residents, and chiefs in Ugunja Sub- County. A sample size of 94 respondents was studied from which comprised of 36 officials of KeRRA, 54 roadside residents and 4 chiefs. Purposive sampling was used to identify the respondents. Questionnaires and interview guides were employed for data collection. Analysis of study variables to answer the research questions were conducted using descriptive statistics of frequency tables, charts, graphs and percentages. Quantitative data was analysed using statistical packages for social sciences. The SPSS was used because it is effective. The study found out that funding, political interference, contract time and human activities greatly influence the durability of rural roads network in Ugunja. The study therefore concluded that a lot need to be done around the cited areas. The study therefore recommended that all stakeholders needs to play their roles in ensuring that the roads remain durable after construction.

**Key Words:** Durability, Road maintenance, rural roads, Human activities, Political Interference

## Introduction

Adequate rural road infrastructure is critical for rural development, and fundamentally relies on effective participation between all parties for example the government, policy makers, planners and the community. Durable roads are very important for day to day activities and as such are required in all sectors for development. The road transport network of any country plays a vital role in determining the chances for reaching a high number of Sustainable Development Goals(SDGs) for example all weather accessible roads, however, the benefits of improved access are short lived if the rural roads are not properly maintained (International Labour Organization, 2007).

Stable and long lasting roads are required globally to enable the accessibility and development of the basic necessities such as education, health, agriculture, industries among others, which are considered among the most important aspects of life (Ramachandran, 2008). Durability is one of the important aspects to be considered when designing a road construction project. The ability of the rural roads to have prolonged service life is what any developer would prefer because it will ensure that the benefits are realised. When roads are constructed to standards that are required, they will serve for long without frequent maintenances and significant deteriorations (Kocher et al., 2007). The provision of stable and long lasting road services is therefore of vital importance for accelerated development.

Generally, some of the aspects considered influencing durability rural road network worldwide include; contract time, availability of funds, political issues among others. Recognizing the important role, rural roads play in agriculture, rural industries and social development (health, education, etc.) makes rural roads of paramount importance, often taking precedence over any new investment for economic development.

Road deterioration due to lack of maintenance has become a growing concern in a number of developing countries (Kocher et al., 2007). The basic object of road maintenance is implicit in the word itself. It is done to ensure that a road that has been constructed or improved is maintained to its original condition. It is accepted that over the life of the road it will deteriorate due to the factors with which maintenance activities cannot deal with like landslides. Nevertheless, maintenance is intended to slow this deterioration and should begin as soon as the road improvement is completed (International Labour Organization, 2007).

According to Ahmad (2006), maintenance is a must for any structure in order to increase its durability and to prevent deterioration

that may shorten the service life. In reality, planning and funding for maintenances has generally been neglected or handled separately from construction that leads to cumulative effects of road deteriorations and finally wear out. However, it is a fact that maintenance is important and the activity to be carried out to prolong or at least maintain stability of roads.

Decades of under-capitalization, poor management and high cost of other means of transport like air and railways have propelled road transport to be the most important means of transport in Africa due to its affordability and accessibility. Improving the roads in Africa has experienced numerous negative factors. Most countries in Africa lack adequate funds to improve their road networks and rely on donors for funding. As these past road networks that were established by the colonial powers are observed to deteriorate at rates exceeding expectations, concern has mounted that policies be undertaken to improve longevity and stability efforts in order to sustain past and current road investments and delay replacement of this necessary infrastructure (Schroeder, 1988).

In 1998, the transport sector in Kenya comprised a road network with 150,000 km of roads and 350,000 vehicles IEA (1998). With a 34% share in the total transport sector in 1998, road transport has the highest contribution to national output among the transport systems. It is followed by air transport, with 25%, and water transport, with 16% (Ikiara et al., 2000). Considering that this level of performance was achieved over a period of deficient road maintenance, it is obvious that the subsector and by implication the road infrastructure policy holds the potential for rapid economic growth and poverty reduction through its influence on production costs, employment creation, access to markets, and investment (RoK, 2000).

Most of the rural roads in Kenya according to the Ministry of Roads (2012) still remain unfinished yet the contracts were awarded a long time ago. This in their report is as a result of awarding contracts to companies which lack the capacity to handle the jobs. Some of the companies were also reported to have done sub-standard jobs resulting into poor quality roads that are short-lived and unstable with bridges being washed away during the rainy season. Therefore this study will be carried out to assess the determinants of longevity and stability of roads in the rural setting of Ugunja Sub- County in Kenya.

Globally, rural roads connectivity is one of key components of rural development as it promotes access to economic and social services generating increased agricultural income and productive employment in various parts of the globe. The world has millions of kilometres of rural roads which have helped ease movements among local communities. However, maintaining these roads to make them stable and durable has always been a challenge.

A substantial portion of rural population in developing countries does not have motorised access to transport network, only unreliable or partial access. It is well documented that ensuring an effective Rural Transport Infrastructure (RTI) system is an essential requirement for rural development. Without reliable access to market and productive resources, economic development stagnates and poverty reduction cannot be sustained. Provision of all season basic access is therefore an essential condition not just for rural development but for development as a whole.

In Siaya County accessible roads are mainly concentrated around Siaya Township and its environs; and nothing much has been done on the rural roads. The status of the roads in Siaya County are unstable and short lived; this means that accessibility is a problem with people, goods and services taking longer time to get to their destination. Many researchers have been done in different regions of Kenya among them are the role of rural roads in poverty alleviation (Njangu, 2015), factors influencing the management of rural roads in Busia County (Esaba, 2012) but little attention have been given to the poor condition of road networks in Ugunja Sub-County. This study therefore, sought to examine the determinants of durability of rural road network in Ugunja Sub- County, Kenya.

The overall objective of this study was to examine the determinants of durability of rural road network in Ugunja Sub- County, Kenya. The specific objectives of the study were to examine the effect of funding by the government on the durability of rural road network in Ugunja Sub-County, Kenya, to determine the influence of political interference on rural road network durability in Ugunja Sub-County, Kenya, to establish the effect of construction contract time on the durability of rural road network in Ugunja Sub- County, Kenya and to determine how human activities influences the durability of rural road network in Ugunja Sub- County, Kenya.

## 1. Literature Review

### 2.1 Constraint Theory

This study was guided by the constraint theory which was developed by Goldratt in 1984. It is a management paradigm that views any manageable system as being limited in achieving more of its goals by a very small number of constraints. There is always at least one constraint, and uses a focusing process to identify the constraint and restructure the rest of the organization around it. It adopts the common idiom "a chain is no stronger than its weakest link." This means that processes, organizations, etc., are vulnerable because the weakest person or part can always damage or break them or at least adversely affect the outcome (Goldratt, 1984).

The theory is used as a methodology for identifying the most important limiting factor (i.e. constraint) that stands in the way of achieving a goal and then systematically improving that constraint until it is no longer the limiting factor. The core concept of the Theory of Constraint is that every process has a single constraint and that total process throughput can only be improved when the

constraint is improved. A very important corollary to this is that spending time optimizing non-constraints will not provide significant benefits; only improvements to the constraint will further the goal (achieving more profit), (Learn Productivity, 2013).

Theory of constraints seeks to provide precise and sustained focus on improving the current constraint until it no longer limits, at which point the focus moves to the next constraint. The underlying power of Theory of Constraint flows from its ability to generate a tremendously strong focus towards a single goal (profit) and to removing the principal impediment (the constraint) to achieving more of that goal. In fact, Goldratt considers focus to be the essence of Theory of Constraint. In project management the Theory of Constraint is based on the idea that all projects look like A-plants: all activities converge to a final deliverable. As such, to protect the project, there must be internal buffers to protect synchronization points and a final project buffer to protect the overall project. According to Khan (2010), the Theory of Constraint is an in improving common process. This is most applicable when handling large projects e.g. road projects, building projects, manufacturing etc.

This theory is applicable in this study on determinants of longevity and stability of rural road project in Ugunja Constituency in that, the goal of achieving durability of the rural roads in question cannot be possible if the constraints i.e. funding by the government, political interference, contract time and human activities are not dealt with. If the determinants above are made adequate and appropriate, then profit maximization in terms of prolong utilization of roads without additional or frequent maintenance is going to be achieved.

## **2.2 Empirical Review**

### **2.2.1 Construction Funding**

According to Yuzdespki and Merkosky (2004) the cost of maintaining rural roads tend to outweigh the cost of construction of a bitumen road. They believe that ideally rural roads carry far much weight in terms of raw materials despite the weather conditions but have always been ignored. In most countries across the globe the estimate cost of maintaining rural roads whether gravel or earth has always been a task as there is no better method of minimizing those costs.

Given the severe lack of resources at the local level, rural road development will continue to require central funding (World Bank, 1995). The financial capacity of the central government is usually limited because of other competing priority areas of development such as health, education etc. Hence, there is usually limited or no funds to carry out maintenance activities, even when this is considered appropriate. Budgetary allocations for road maintenance are usually inadequate, often times, the funds that eventually get released are small fractions of the original requirement. This limits the scope, quantity and quality of maintenance work that can be done. Generally, whenever the maintenance funds are released, they are grossly inadequate, rural roads are the first casualty for neglect. The application of labour based method in these circumstances will ensure sustainable road maintenance system, and also allow creation of strategies and institutional arrangements which will facilitate the maintenance of rural roads within such limited funds.

A report by the World Bank (2010), looking at infrastructure in Sub-Saharan Africa also casts doubt on the viability of exclusion through toll financing, even for major trunk roads. It notes that toll roads currently make up only 0.1% of the region's formal road network, and that these are found almost entirely in South Africa. Going further, it estimates that a minimum traffic volume of 15,000 vehicles a day is necessary for toll concessions to be economically viable, and that these conditions exist on less than 10% of the existing Sub-Saharan road network, with these areas concentrated in South Africa and some areas of Nigeria

Rafiqui (2003) provides a different perspective, where questions of economic viability combined with a lack of local legal ownership over community-constructed and maintained roads have been found to undermine the ability of communities to exclude and charge tolls to non-local users. The author also notes initiatives organized by the Swedish International Development Cooperation Agency (SIDA) and others that provide models for community roads and use taxation of non-community members to provide at least partial finance for them. Exclusion may therefore be possible but requires a legal framework and an acceptance that this cannot be the main source of road financing under most circumstances. Although the provision of rural road infrastructure had been devolved to the county level, the allocation of development funds is still centralized and the central government has continued to control counties through the financial purse.

A study in Uganda (Ministry of Works and Transport, 2003), into the funding needs for road networks, recommended that extra funding to be dedicated to increase the proportions of the paved roads in good or fair conditions from 74% - 89%. To achieve this, a higher priority was given to routine and periodic maintenance and rehabilitation of roads in poor conditions. The post-independence era of the late 1950 and 1960s saw a substantial expansion of national road networks. In most African countries by the end of the 1980 over 2 million kilometres of roads had been constructed with an asset value of \$150 billion. However, the expansion of the networks was not matched with commensurate funding for maintaining the infrastructure. The result was that by 2000 over 33 per cent of the asset value had been lost due to lack of routine and periodic maintenance (World Bank, 2009).

Most analysts (for example, Nalo 1993; World Bank 1995; Kimuyu & Mugerwa, 1998) agreed that the conditions of road networks in Kenya especially in the rural areas began to deteriorate extensively in the 1980s. This was partly because overall road funding fell and priority was given to development rather than the maintenance of the existing road networks. According to Kimuyu and Mugerwa (1998), the revenues available to the road sector are inadequate to maintain the road networks in their stable, long-term conditions and to undertake necessary improvements. A larger portion of funding for maintenance of these roads to increase their

durability, is concentrated at the top tier of the road networks in Kenya, thus the national highways receive the lions' share of any maintenance funding that is available with the remaining amount of funds reduced at each level up to the village roads (World Bank, 2002).

### 2.2.2 Political Interference

Issues of political salience or patronage may affect road construction, while community dynamics may shape local use and access to roads (Wales & Wild, 2012). Governments in the Sub-Saharan Africa are made of politicians. For any decision to be arrived at, politicians have to be engaged (Riverson, 1998). As it is known politicians are elected by communities so as to represent them and their needs. These politicians make the government and will tend to favour certain areas when it comes to development (Levick, 2003).

According to Van de Walle and Mu (2007), in Vietnam the preference for rural road construction over and above maintenance, and the willingness to transfer aid money for that purpose, indicates that local politicians view road construction as more politically salient and face political incentives that reward them for prioritizing construction over maintenance.

According to Wilson (2004), in the context of Peru, looking at both the modern era and the immediate post-Independence period; the ability of road construction to allow greater government influence in the provinces and easier mobilization of the coercive force of the state meant that, even where roads were not demanded, or even were resisted, they were still eventually provided. In the current era, there is a clear alignment between salience emerging from this desire to expand state authority and demand from rural people for connectivity. This ensures that road construction is highly political salient task and that, to a large extent, maintenance loses out as a result. Roads play critical roles as political capital in my study area i.e. Ugunja Sub-County. Decisions about where roads should be built, which road should be upgraded and which should be maintained are heavily influenced by prevailing political context (Hamala, 2007).

In Bangladesh according to Farhad (1997) politics plays an important role in any form of development. Road construction and any form of maintenance largely dependent on politics. According to him like any other developing country without any proper structures some areas are more developed than the rest as a result of political decisions. Rural areas whose representatives are not in government tend to be less developed as most of the government projects are deviated to other areas whose representatives are directly in power. Contractors benefit when politicians who they are connected to win offices. These politicians appear to be intervening in the allocation of contracts on behalf of members of their own networks even though they have no official role in making contracting decisions. These favoured contractors build very expensive roads without any observable differences in quality. Hence it is evident that democratically elected politicians use their powers improperly to benefit connected firms and individuals at the expense of the larger population who suffer from sub-standard or poorly built roads (Farhad, 1997).

In Malawi like other African countries, as observed by the World Bank 2009 Country Economic Memorandum (CEM, 2009) the poor state of the unpaved roads can be attributed to politics. The regime during the time of survey had its pressure on maintaining and rehabilitating some given roads due to political pressure from certain individual politicians.

Leyland (2003) noted that in East Africa countries, there are also little recognition by politicians of the importance of routine maintenances and preservation of the existing maintainable road networks as opposed to spending more money opening up or improving other roads which garner more political support.

Kenya provides a good example of how ethnic polarization can lead to political market imperfections that then provide incentives for road construction targeted for patronage purposes. Burgess et al. (2009) examine this case in detail, noting that Kenya has great ethnic and regional fragmentation, with five groups comprising 70% of the population, which have a high degree of geographic concentration and social segregation. They argue that this provides the ideal conditions for ethnic favouritism and patronage politics, as resources can be targeted to politicians' ethnic power bases with considerable ease and strong identities provide a common point of political identification for poorly informed voters. For the roads sector, this contributes to the diversion of resources (chiefly paved road construction projects) towards areas that have provided support for ruling parties and politicians.

Burgess et al. (2009) demonstrate this by analysing a comprehensive dataset of post-Independence era information on road construction patterns in Kenya, the (relatively unchanged) geographic distribution of ethnic groupings and the identities and home regions of central government ministers. They find strong evidence that road expansion in any given year is closely related to the home regions of the prime minister and the minister of public works, and to ethnic groups represented in the Cabinet, with the second largest group receiving a particular boost. This suggests that politicians have used road construction as a mechanism for distributing patronage, either to secure their own power bases, or to ensure political stability. This may contribute to under-provision of roads in some areas and a deterioration of the road network in areas that lack a high-ranking minister or political connections.

### 2.2.3 Construction Contract Time

Time also is always a factor highly influenced by the general population. If the community has demanded the need for use of a road at a given time it requires that the responsible contractor to be up and finish his job in the shortest time possible. Going beyond the time limit set always triggers questions of competency.

Rural roads unlike the sophisticated urban roads have a short time season of completion. Considering the fact that it is almost impossible to do maintenance in wet weathers contractors always have limited time. Besides, these roads also consider the agricultural pattern of the area. As it is known that the rural roads are meant to assist in transportation of agricultural products maintenance should consider which time of the year trucks are not likely to use the roads. Nevertheless, country policies also dictate the time given to a contractor to complete a road. This is always as a result of government intending to ensure completion of rural roads at a particular time. The time set for constructions is mostly set based on millage and expects contractors to be done at a particular time of the year as per the distances they are covering (ADB, 2012).

According to Tighe (2000), the reason for most of the countries giving limited time for any form of road project is the belief that all contractors have the necessary technology for the job. In his article: Why use Labour based Technology? He argues that the labour based technology improves speed of construction. It enables easy movement of earth and gravel that reduces the time needed for construction.

### 2.2.4 Human Activities

Local institutions and communities (which include local government below state level) have usually been involved in rural road projects at planning stage and in maintenances. As far as maintenance is concerned, results have been disappointing. Activities ranging from driving along road shoulders, blocking culverts and other drainage channels would hamper the life span of roads (Kocher et al., 2007).

When road users decide to farm closer to the roads and provide water channels directly to the roads, this would bring about erosion which would deteriorate the lifespan of the road either paved or unpaved. Road maintenance should be considered unavoidable necessity of living in rural areas. People should take time to learn about roads because when they are well designed and maintained they have fewer negative impacts on the environment, are more reliable and cost less to maintain. Poorly designed, maintained and located roads have a higher risk of failing during storms than those which are properly designed and maintained.

Globally, literatures have shown much on issues surrounding managing rural roads maintenance and the obstacles faced. Studies that have been carried out in Kenya include: factors influencing maintenance of roads by Kenya Rural Roads authority (Esaba, 2014) and factors influencing maintenance of rural roads network (Njangu, 2015). However, these studies lack detailed information on effectiveness of managing rural road network durability. This work will be a modest attempt to fill this knowledge gap.

## 2. Methodology

This study was conducted using descriptive study design by employing both qualitative and quantitative approaches. This method was chosen because enabled the researcher to explore all the variables in the study in order to investigate the determinants of durability of roads in Ugunja Sub-County.

The target population of the study was 120 employees of Kenya Rural Roads Authority (KeRRA), the chiefs and sub-chiefs (4) and road side residents (180) in Ugunja Sub-County. The researcher believed that the selected key informants including the Kenya rural roads authority officials, chiefs and the road side residents possess more knowledge on the determinants of durability of rural road network in Ugunja Sub-County.

Table 3.1: Target Population

Category	Target Population
KeRRA officials	120
Chiefs	6
Roadside residents	180
<b>Total</b>	<b>306</b>

Sample size of Kenya Rural Road Authority officials (36) and that of the roadside residents (54) was arrived at by using the Mugenda & Mugenda (2003) criterion of 30% the target population. Because the target population of the chiefs is small (4), the researcher included all of them (chiefs and sub-chiefs) on the study as shown below;

Table 3.2: Sample Size

Category	Target Population	Sample Size (30% Target Population)
KeRRA officials	120	36
Chiefs	4	4

Roadside residents	180	54
<b>Total</b>	<b>360</b>	<b>91</b>

The sample size was therefore 91 respondents and purposive sampling and non-probability sampling procedure was used to select the respondents and interviewees because it specifically allowed the researcher to select a sample that was of interest to the study.

Primary data were collected using questionnaires and interview guide. The study also utilised the secondary data from journals and even the Kenya Rural Roads Authority records on durability of rural road network.

Questionnaire were the main tool used for data collection because they are more objective and gather responses in a more systematic way, while at the same time ensures confidentiality to the respondents (Kothari, 2007). It was administered to the respondents who in this case were the officials of Kenya Rural Roads Authority by the researcher with the help of research assistants.

Semi structured questionnaires with both open and closed ended questions were used. The researcher also used matrix and contingency questions within the study. (Mugenda & Mugenda, 2003) states that these are questions that are only answered if respondent gives particular response to a previous question. The questions were grouped into sections based on the objectives of the study.

Structured interview guide was used in getting information from chiefs and sub-chiefs, and the roadside residents. The interview guide had the same questions for this category of the respondents. Interview guides gives first hand, more accurate and reliable information as responses could be clarified by respondents.

These instruments were designed for the category of interviewee based on the four research objectives i.e. funding by the government, political interference, contract time and human activities. Social cues, such as voice, intonation, body language etc. of the respondents was a key influencer of using this method, other factors such as synchronous communication were also considered. According to Best and Kahn (2005) interview is superior to other instruments in that it creates rapport between the respondent and the researcher.

A letter of introduction was obtained from Catholic University of Eastern Africa .This was used to acquire permit to conduct the study. The questionnaires were given to specific respondents and collected there or later during the day and the interviews were administered and collected there and there.

After the completion of data collection, data were arranged and grouped according the four questions for the study. Analysis of study variables to answer the research questions were conducted using descriptive statistics of frequency tables, charts, graphs and percentages.

Quantitative data were analysed using Statistical Packages for Social Sciences version 20.0. The SPSS package was used because it is effective in handling large amount of data for analysis. Qualitative data were analysed through content analysis which in turn were analysed by organizing the data into themes, patterns and sub topics. Frequency tables, pie charts, percentages and graphs were used to present the results of the analysis for ease of understanding and interpretation. Phenomenological approach was used to analyse qualitative data in order to bring out the experience of the respondents meaning that the study attempts to understanding the perceptions, perspectives and understanding of a particular situation meaning.

Reliability was tested through test-retest method. This technique involved administering the questionnaires twice within a period of two weeks after which the scores in the two sets would be correlated. The researcher would use Pearson’s moment co-efficient approach to determine the co-efficient of correlation using the formula shown;

Where

$$r = \frac{N\sum xy - (\sum x) (\sum y)}{\sqrt{(\sum x^2) - (\sum x)^2 (\sum y^2 - (\sum y)^2)}}$$

Where r = person correlation co-efficient

X = result from the first test

Y= results from the second test

N = number of observations

A correlation coefficient of 0.7 to 1 is considered reliable (Mugenda & Mugenda, 2003).According to Mugenda and Mugenda (2003), a coefficient of 0.80 or more simply shows that there is high reliability of data. If the instrument will realize a Pearson product correlation coefficient (r) of 0.75 it will be deemed reliable.

Validity according to Borg and Gall (1989), is the degree to which a test measures what it purports to measure. Wiersma (1995) adds that all assessments of validity are subjective opinions based on the judgment of the researcher. The researcher ensured validity by giving the questionnaires to professionals or experts in research for assessment as recommended by Mugenda (2003).

The questionnaires were given to two experts. The first expert was requested to assess what the questionnaire is trying to measure. The second one was asked to determine whether the set of items accurately represents the concept under study. The qualitative study instruments were tested by doing a pilot study on the same population to determine if the questions are answering what they are supposed to answer.

Department of Social Sciences and Development Studies of the Catholic University of Eastern Africa (CUEA) gave authorization for field work. For the researcher to have carried out the study, she sought permission from the National Council of Science and Technology and Innovation (NACOSTI). The researcher informed the respondents that the purpose of the study is purely academic and assure them of confidentiality and anonymity. Participants were not required to indicate their names on the questionnaire. The researcher administered the questionnaires personally and collects them at the agreed time once they are filled. Interviews were also scheduled with the interviewees to enable the researcher gather all the information needed.

### **3. Summary of Findings, Conclusions and Recommendations**

#### **4.1 Summary of Findings**

The purpose of this study was to examine the determinants of durability of rural roads networks in Ugunja Sub-County, Siaya County, Kenya. The study was guided by the following research questions: What are the effects of funding by the government on the durability of rural roads network in Ugunja Sub-County? How does political leadership influence the durability of rural roads network in Ugunja Sub-County? What are the effects of human activities on the durability of rural roads network in Ugunja Sub-County and finally what are the effects of construction contract time influence on the durability of rural roads program in Ugunja Sub-County, Kenya?

The study employed descriptive study design. KeRRA employees, chiefs and roadside residents in Ugunja Sub-County, Siaya County, Kenya were the targeted population. Purposive sampling was used to arrive at a sample 94 consisting of 36 KeRRA officials, 4 chiefs and 54 roadside residents. Data was collected using questionnaires and interview guide. Questionnaires were used to collect data from the KeRRA employees while interview guides for the chiefs and roadside residents.

Collected data was analysed with the help of Statistical Packages for Social Sciences (SPSS).Data from questionnaire was analysed quantitatively and presented in frequencies and percentages while data from interview guides was analysed qualitatively and its findings integrated within the quantitative data. From the analysis, the study came up with the following summary of findings presented below based on the research questions.

##### **4.1.1 Construction Funding**

Findings established that funding influence maintenance of rural roads to make them stable and durable to a very great extent as indicated by 57.1% of the respondents whereby the funds received for rural road construction were unreliable as indicated by 45.7% and funds allocated to KeRRA are slightly adequate as indicated by 62.9%of the respondents. This finding is in agreement with Kimuyu and Mugerwa (1998) that the revenues available to the road sector are inadequate to maintain the road networks in their stable, long-term conditions and to undertake necessary improvements.

##### **4.1.2 Political Leadership**

The findings revealed that of political interference influence durability of rural roads as indicated by 68.6% of the respondents whereby political leaders determine which rural roads are to be maintained or constructed to a very great extent as indicated by 57.1% although there is a time when the relevant bodies do not respect political decisions on which roads to maintain as indicated by 71.4% of the respondents. This concurs with Farhad (1997) that politics plays an important role in any form of development especially road construction and any form of maintenance largely dependent on politics.

##### **4.1.3 Construction Contract Time**

Findings established that construction contract time influence durability of rural roads whereby all rural projects are not carried out on time and the rush contributes to substandard roads as indicated by 62.9% at the same time, there are penalties if contractors do not complete the projects in time as indicated by 57.4% of the respondents. This is in agreement with ADB(2012) that contractors have little time for road construction in rural areas thus they should be allowed to schedule their completion time.

##### **4.1.4 Human Activities**

Findings established that human activities which included poor driving along the road, blockage of culverts and farming close to the road influence stability and durability of roads to a great extent as indicated by 42.9%of the respondents. Findings also established that KeRRA does not hold seminars or road shows to create awareness to the public on road usage and preservation as indicated by 42.9% of the respondents hence KeRRA experience problems as far as human activities from the locals are concerned occasionally as indicated by 57.1%. However, KeRRA sometimes educate the public on road issues as indicated by 28.6% although in most cases they result to doing repairs and take no action to members of the public who damage the road and the road reserves as indicated by 57.1%of the respondents. This finding is in line with (Kocher et al., 2007) that human activities ranging from driving along road shoulders, blocking culverts and other drainage channels would hamper the life span of roads.

## **4.2 Conclusions**

On the objective of funding by the government, the study concluded that the funding procedure for the construction or maintenance of rural roads move from the national government to the county government and then disbursed to relevant bodies like the Kenya Rural Roads Authority who currently from the study, receives a smaller fraction of the total fund disbursed by the national government hence inadequate to cater for proper and routine maintenance and construction of these rural road networks.

The study further concluded that Political leadership influences the durability of rural road networks. Political leaders are key players in making decisions as to which roads needs to be constructed, maintained or rehabilitated and mainly tends to concentrate or favor areas where they have strong political support. Political leadership has emerged to be a very influencing factor behind any development efforts hence needs a lot of attention when planning for such developments.

The study is also in agreement with time as a factor that influences durability of rural road network. Most road construction works takes very long time to be completed and things even grow worse when it is rainy season. This leads to a lot of cumulative deteriorations that takes very long time to be repaired hence making the areas very inaccessible. The study therefore concluded that time needs to be given consideration when allocating contracts for long lasting and standard results of road construction.

The study findings also showed that there is influence of human activities in the durability of rural road networks. These have the effect of damaging the roads hence increasing the maintenance costs and in some cases even leading to change of design from the original one.

## **4.3 Recommendations**

### **4.3.1 Policy Recommendations**

From the inadequacy of funds received by Kenya Rural Roads Authority for the construction and maintenance of rural roads networks, the study recommended that the road funding should be increased so that more rural roads can be constructed and the existing ones can be expanded, properly maintained and put in a good condition to speed up development in all sectors in rural areas. This will also increase productivity of other sectors that rely on good road networks for their effectiveness like the agricultural and industrial sectors.

The study also recommends that Political leadership involvement in matters of roads construction and maintenance should be minimized with the presence of the bodies like KeRRA who are responsible for the same. Being a key influence on most decisions pertaining to roads constructions, there is need to have all key stakeholders look at the wider societal benefits and a balance between cost and political mileage. Both the national assembly and the county assembly should clearly come up with an act and procedure on the extent of involvement of the political leaders on rural roads development.

The study further recommended that constructors should be allowed to allocate time that they feel is adequate to construct roads that are durable, stable and to the standards required because they understand their abilities. Giving those deadlines without putting quality in the forefront has resulted into very sub-standard works. Contractors should be allowed to schedule the project completion time to avoid constructing roads in a hurry which results to unstable and short-lived roads.

The general public plays very critical role in rural roads construction and even maintenance. They should be sensitized on usage of roads and their importance in economic development so that they can contribute positively towards efficient maintenance of these roads. Human activities such as farming along road reserves that leads to erosion of road shoulders could be minimized. The efforts of local communities participation needs to be integrated into the process of rehabilitation and maintenance of roads.

Incorporation of Labor Based Approach (LBA) in the maintenance of rural roads is important as it instills sense of ownership and plants a good maintenance regime and therefore recommended for the agencies involved.

### **4.3.2 Recommendations for Further Studies**

This study was carried out to assess the determinants of durability of rural roads network in Ugunja Sub-County only and did not take into consideration other Counties and therefore recommended the study to be done in other counties in Kenya for the comparison of results and also to mobilize a lasting solution to the poor conditions of rural roads.

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**REFERENCE TABLES AND CHARTS**

Table 4.1: Instrument Return Rate

Respondents	Sample size	No. collected	Return rate (%)
KeRRA staff	36	30	83.3
Village chiefs	4	4	100.0
Roadside residents	54	45	83.0

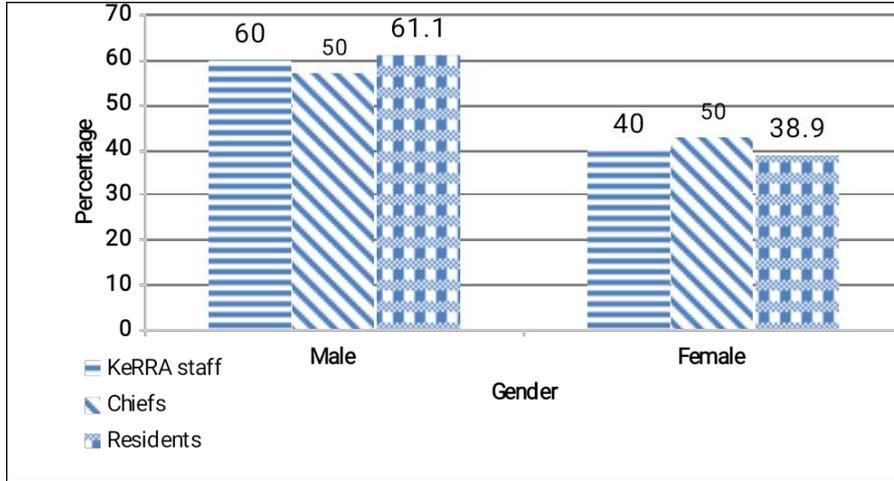


Figure 4.1: Gender of Employees, Residents and Chief

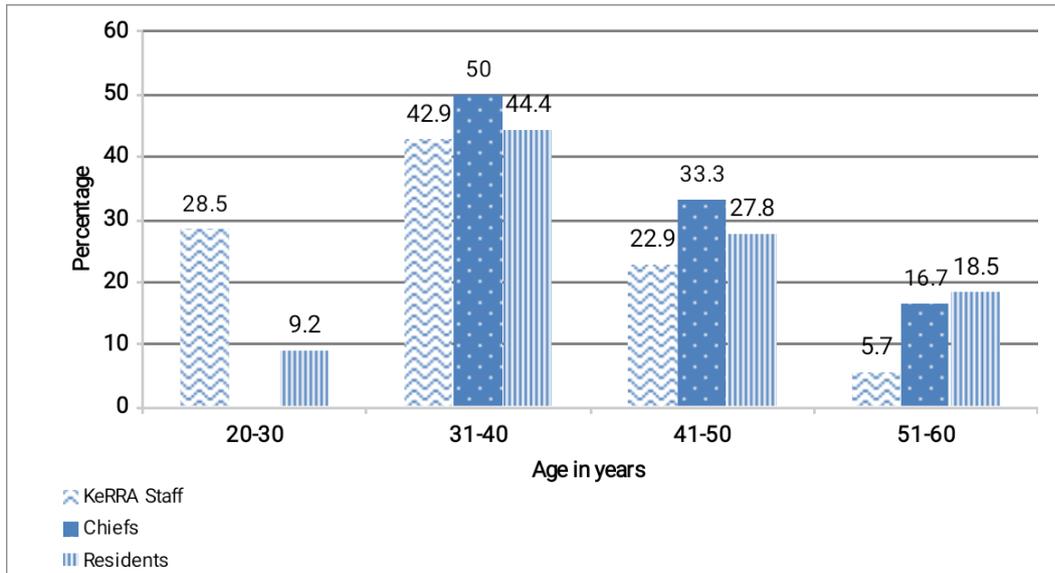


Figure 4.2 Age of KeRRA Staff, Residents and Chiefs

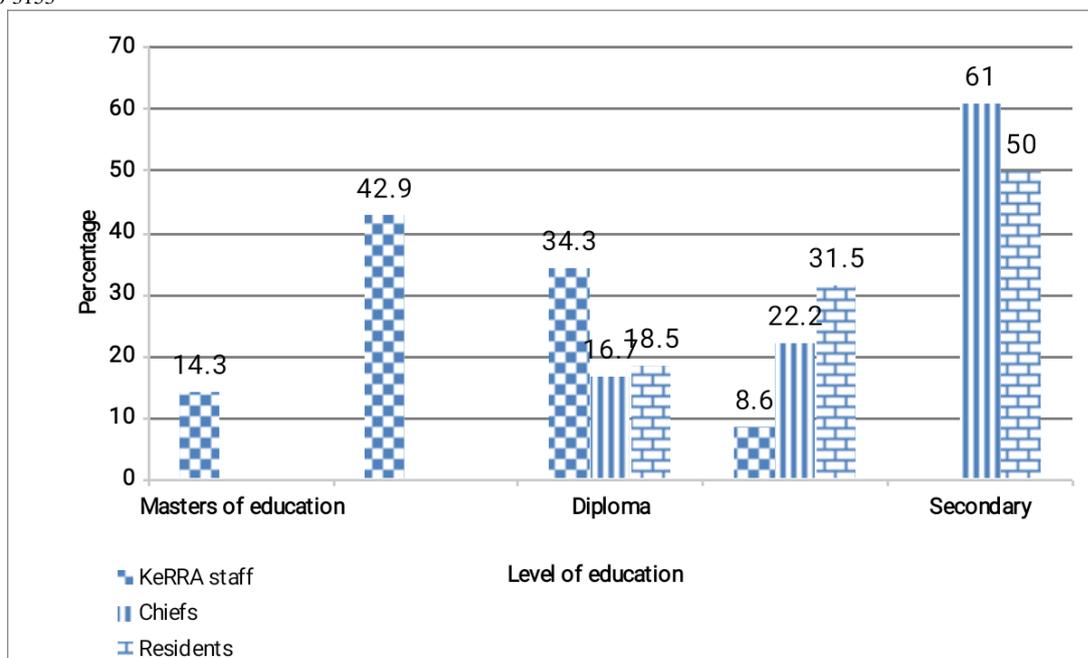


Figure 4.3: Education Level for KeRRA Staff, Residents and Chiefs

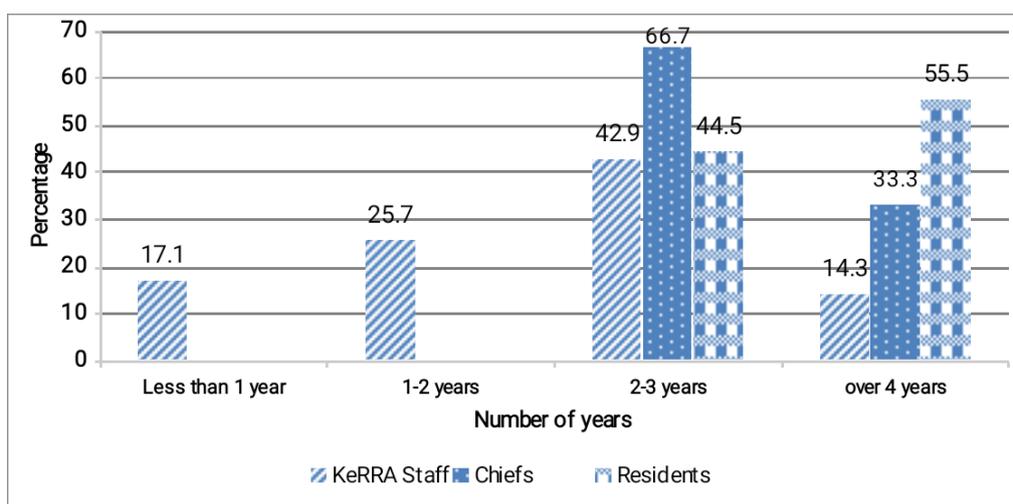


Figure 4.4: Number of Years in the Current Station

Table 4.2: Adequacy of Funds Allocated to KeRRA

Adequacy of funds allocated to KeRRA	Frequency	Percentage
Inadequate	5	14.2
Slightly adequate	22	62.9
Adequate	8	22.9
Total	35	100

Table 4.3: Reliability of Funds Received for Rural Road Construction

Reliability of funds received	Frequency	Percentage
Reliable	4	11.4
Unreliable	16	45.7
Sometimes reliable	5	14.3
Very unreliable	10	28.6
Total	35	100

Table 4.4: Extent to which Funding Influence Maintenance of Rural Roads

Extent to which funding influence maintenance of rural roads	Frequency	Percentage
Very great Extent	20	57.1
Great extent	10	28.6
Moderate extent	5	14.3
Total	35	100

Table 4.5: Sources of Finances that KeRRA Uses

Sources of finances that KeRRA uses	Frequency	Percentage
Central government	15	42.9
Local government	10	28.6
World bank	10	28.6
Total	35	100

Table 4.6: Relationship between Funding and Durability of Roads

Model	Coefficients		Standardized Coefficients	t	Sig.
	Unstandardized Coefficients				
	B	Std. Error			
(Constant)	-.071	.162	-.441	.662	.000
How reliable are the Funds for rural road construction received	.632	.058	.885	10.897	.000

Table 4.7: Political Leadership and Rural Roads Maintenance

Responses	Frequency	Percentage
Yes	24	68.6
No	11	31.4
Total	35	100

Table 4.8: Extent to which Political Leadership Influence Maintenance of Rural Roads

Extent to which political leadership influence maintenance of rural roads	Frequency	Percentage
Very great Extent	20	57.1
Great extent	10	28.6
Moderate extent	5	14.3
Total	35	100

Table 4.9: Respect of Political Decisions on which Roads to Maintain

Responses	Frequency	Percentage
Yes	25	71.4
No	10	28.6
Total	35	100

Table 4.10: Relationship between Political Interference and Durability of Roads

Model	Coefficients		Standardized Coefficients	t	Sig.
	Unstandardized Coefficients				
	B	Std. Error			
(Constant)	1.045	.238	.229	4.402	.000
1 Do political leadership play a role in decision making for rural roads maintenance	.705	.170	.584	4.135	.000

Table 4.11: Opinions on Influence of Time on Road Durability in Ugunja Sub-County

Statements	Yes		No	
	F	%	F	%
All rural roads projects are carried out on time	15	42.9	20	57.1
Contractors complain of shorter time limit for completion of projects	11	31.4	24	68.6
If contractors do not complete the projects in time are there penalties	22	62.9	13	37.8

Table 4.12: Whether Contractors should be allowed to Schedule their Project Completion Time

Level of agreement	Frequency	Percentage
Strongly agree	3	8.6
Agree	15	42.9
Somehow agree	10	28.6
Disagree	7	20.0
Total	35	100

Table 4.13: Relationship between Time and Durability of Roads

Coefficients		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
	(Constant)	.182	.216	.842	.406	.000
1	To what extent to you agree that contractors should be allowed to schedule their project completion time	.517	.109	.940	4.746	.000

Table 4.14: Extent to which Human Activities Influences durability of Rural Roads

Extent to which human activities influence its stability and durability	Frequency	Percentage (%)
Very great Extent	12	34.2
Great extent	15	42.9
Moderate extent	8	22.9
Total	35	100

Table 4.15: Seminars or Road Shows to Create Awareness to the Public

Responses	Frequency	Percentage (%)
Yes	15	42.9
No	20	57.1
Total	35	100

Table 4.16: Frequency of Human Activities Problems

Frequency	Frequency	Percentage (%)
Never	3	8.6
Occasionally	20	57.1
Always	12	34.3
Total	35	100

Table 4.1: How KeRRA Handle Cases of Members of the Public Damaging the Road

Frequency	Frequency	Percentage (%)
Educate them on road issues	10	28.6
Prosecute them to pay for damages	5	14.3
Do repairs and take no action	20	57.1
Total	35	100

Table 4.18: Relationship between Human Activities and Durability of Rural Road Network

Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.255	.326	-.781	4.440	.000
How often do you experience problems as far as human activities from the locals are concerned	.948	.139	.764	6.801	.000